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U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

SPECIFICATION

MICROWAVE LANDING SYSTEM (MLS)

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August 30, 1990

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TABLE OF CONTENTS

1	SCOPE.	1
1.1	IDENTIFICATION.	1
1.2	SYSTEM OVERVIEW.	1
1.2.1	Category II MLS.	2
1.2.2	Category III MLS.	2
1.3	DOCUMENT OVERVIEW.	2
2	APPLICABLE DOCUMENTS.	5
2.1	GOVERNMENT DOCUMENTS.	5
2.1.1	Specifications.	5
2.1.2	Standards.	6
2.1.3	Drawings.	9
2.1.4	Other Publications.	9
2.2	NON-GOVERNMENT DOCUMENTS.	10
2.2.1	Specifications.	11
2.2.2	Standards.	11
2.2.3	Drawings.	12
2.2.4	Other Publications.	12
3	SYSTEM REQUIREMENTS.	17
3.1	SYSTEM DEFINITION.	17
3.1.1	Azimuth Station.	17
3.1.1.1	Azimuth equipment.	17
3.1.1.2	DME/P equipment.	17
3.1.1.3	Back Azimuth.	17
3.1.1.4	Data Words.	17
3.1.2	Elevation station.	17
3.1.2.1	Elevation equipment.	18
3.1.3	Signal format.	18
3.2	CHARACTERISTICS.	18
3.2.1	Performance Characteristics.	18
3.2.1.1	Azimuth equipment.	18
3.2.1.1.1	Accuracy.	19
3.2.1.1.1.1	Accuracy stability.	19
3.2.1.1.2	Antenna design features.	19
3.2.1.1.2.1	Aperture.	19
3.2.1.1.2.2	Beam steering.	19
3.2.1.1.2.3	Environmental effects.	22
3.2.1.1.2.4	Grating lobes.	22
3.2.1.1.3	Function Synchronization.	22
3.2.1.1.3.1	Transmission cycle.	22
3.2.1.1.3.2	Stability.	22
3.2.1.1.4	Not Used.	31
3.2.1.1.5	Angle guidance signal requirements.	31
3.2.1.1.6	Transmitter requirements.	31
3.2.1.1.6.1	Channel selection.	31
3.2.1.1.6.2	Minimum output power.	31
3.2.1.1.6.3	Output power adjustment.	31
3.2.1.1.6.4	Radio frequency signal spectrum.	31

TABLE OF CONTENTS

1	SCOPE.	1
1.1	IDENTIFICATION.	1
1.2	SYSTEM OVERVIEW.	1
1.2.1	Category II MLS.	2
1.2.2	Category III MLS.	2
1.3	DOCUMENT OVERVIEW.	2
2	APPLICABLE DOCUMENTS.	5
2.1	GOVERNMENT DOCUMENTS.	5
2.1.1	Specifications.	5
2.1.2	Standards.	6
2.1.3	Drawings.	9
2.1.4	Other Publications.	9
2.2	NON-GOVERNMENT DOCUMENTS.	10
2.2.1	Specifications.	11
2.2.2	Standards.	11
2.2.3	Drawings.	12
2.2.4	Other Publications.	12
3	SYSTEM REQUIREMENTS.	17
3.1	SYSTEM DEFINITION.	17
3.1.1	Azimuth Station.	17
3.1.1.1	Azimuth equipment.	17
3.1.1.2	DME/P equipment.	17
3.1.1.3	Back Azimuth.	17
3.1.1.4	Data Words.	17
3.1.2	Elevation station.	17
3.1.2.1	Elevation equipment.	18
3.1.3	Signal format.	18
3.2	CHARACTERISTICS.	18
3.2.1	Performance Characteristics.	18
3.2.1.1	Azimuth equipment.	18
3.2.1.1.1	Accuracy.	19
3.2.1.1.1.1	Accuracy stability.	19
3.2.1.1.2	Antenna design features.	19
3.2.1.1.2.1	Aperture.	19
3.2.1.1.2.2	Beam steering.	19
3.2.1.1.2.3	Environmental effects.	22
3.2.1.1.2.4	Grating lobes.	22
3.2.1.1.3	Function Synchronization.	22
3.2.1.1.3.1	Transmission cycle.	22
3.2.1.1.3.2	Stability.	22
3.2.1.1.4	Not Used.	31
3.2.1.1.5	Angle guidance signal requirements.	31
3.2.1.1.6	Transmitter requirements.	31
3.2.1.1.6.1	Channel selection.	31
3.2.1.1.6.2	Minimum output power.	31
3.2.1.1.6.3	Output power adjustment.	31
3.2.1.1.6.4	Radio frequency signal spectrum.	31

3.2.1.2.11.1 Proportional Guidance Adjustability.	47
3.2.1.2.12 Out-of-Coverage indication (OCI).	47
3.2.1.2.13 Elevation antenna requirements.	47
3.2.1.2.13.1 Scanning beam antennas (Elevation).	47
3.2.1.2.13.1.1 Patterns.	47
3.2.1.2.13.1.2 Alignment and tilt controls.	48
3.2.1.2.13.1.3 Antenna stability.	50
3.2.1.2.13.1.4 Polarization.	50
3.2.1.3 Data Transmission.	50
3.2.1.3.1 Basic Data.	50
3.2.1.3.1.1 Status information.	50
3.2.1.3.2 Auxiliary Data.	50
3.2.1.4 Precision Distance Measuring Equipment (DME/P).	51
3.2.1.4.1 General DME/P Requirements.	51
3.2.1.4.2 DME/P equipment.	51
3.2.1.4.3 Transponder Characteristics.	51
3.2.1.4.3.1 General Performance.	51
3.2.1.4.3.1.1 Range.	52
3.2.1.4.3.1.2 Coverage.	52
3.2.1.4.3.1.3 Transponder accuracy.	52
3.2.1.4.3.2 Radio frequencies and polarization.	52
3.2.1.4.3.3 Channeling.	52
3.2.1.4.3.3.1 DME channels.	52
3.2.1.4.3.3.2 Pulse coding.	52
3.2.1.4.3.3.3 DME/P operating channels.	52
3.2.1.4.3.4 Reply efficiency.	53
3.2.1.4.3.5 Transponder identification.	53
3.2.1.4.3.6 Squitter pulses.	53
3.2.1.4.4 Specific transponder requirements.	53
3.2.1.4.4.1 Transmitted signal characteristics.	53
3.2.1.4.4.1.1 Radio frequency stability.	53
3.2.1.4.4.1.2 Pulse shape.	55
3.2.1.4.4.1.2.1 Pulse rise time.	55
3.2.1.4.4.1.2.2 Pulse width.	55
3.2.1.4.4.1.2.3 Pulse decay time.	55
3.2.1.4.4.1.2.4 Ripple.	55
3.2.1.4.4.1.2.5 Pulse Pedestal.	55
3.2.1.4.4.1.3 RF pulse signal spectrum.	58
3.2.1.4.4.1.3.1 Out-of-band spurious output.	58
3.2.1.4.4.1.3.2 In-band spurious output.	58
3.2.1.4.4.1.3.3 Harmonics.	58
3.2.1.4.4.1.4 Polarization.	58
3.2.1.4.4.1.5 Power densities.	59
3.2.1.4.4.1.6 Signals transmitted.	59
3.2.1.4.4.1.6.1 Replies to valid interrogations.	59
3.2.1.4.4.1.6.2 Morse Code identification.	61
3.2.1.4.4.1.6.3 Squitter outputs.	62
3.2.1.4.4.1.7 Priority of transmission.	62
3.2.1.4.4.2 Interrogation signal reception and processing requirements.	63
3.2.1.4.4.2.1 Transponder threshold sensitivity.	63

3.2.1.4.4.2.1.1	Signal level variations.	64
3.2.1.4.4.2.1.2	Sensitivity variation with pulse coding.	64
3.2.1.4.4.2.1.3	Sensitivity variation with frequency.	64
3.2.1.4.4.2.1.4	Sensitivity variation with interrogation loading.	64
3.2.1.4.4.2.1.5	Sensitivity variation with adjacent channel interrogations.	65
3.2.1.4.4.2.1.6	Sensitivity variation with closely spaced pulses.	65
3.2.1.4.4.2.2	Reply efficiency variations.	66
3.2.1.4.4.2.2.1	Random single pulses.	66
3.2.1.4.4.2.2.2	Continuous Wave (CW) interference.	66
3.2.1.4.4.2.3	Input signal blanking.	67
3.2.1.4.4.2.4	Decoding dead time.	67
3.2.1.4.4.2.5	Echo suppression.	67
3.2.1.4.4.2.6	Interrogation overload.	68
3.2.1.4.4.3	Transponder required design features.	68
3.2.1.4.4.3.1	Transponder receiver bandwidth.	68
3.2.1.4.4.3.2	Warm-up times.	68
3.2.1.4.4.3.3	Output protection.	68
3.2.1.4.4.3.4	Antenna.	68
3.2.1.4.5	Station power.	69
3.2.1.4.5.1	Site and equipment power.	69
3.2.1.4.5.2	Battery supply.	69
3.2.1.4.5.3	Power supply.	69
3.2.1.4.5.4	Voltage regulators.	69
3.2.1.4.5.5	Convenience outlets.	69
3.2.1.5	Remote control, status and monitoring require- ments.	69
3.2.1.5.1	Remote Control and Status Unit.	69
3.2.1.5.1.1	RCSU Electronics Unit.	69
3.2.1.5.1.1.1	Interface requirements.	69
3.2.1.5.1.1.2	Physical requirements.	70
3.2.1.5.1.2	RCSU Panel.	70
3.2.1.5.1.2.1	Control and display features.	70
3.2.1.5.1.2.2	Physical requirements.	73
3.2.1.5.2	Remote Status Unit (RSU).	73
3.2.1.5.2.1	Interface requirements.	73
3.2.1.5.2.2	Display features.	73
3.2.1.5.2.3	Physical requirements.	74
3.2.1.6	Equipment Control and Status.	75
3.2.1.6.1	Azimuth/Elevation.	75
3.2.1.6.1.1	Responses to executive monitor inputs.	75
3.2.1.6.1.1.1	Integrity alarms.	75
3.2.1.6.1.1.1.1	Standby status.	75
3.2.1.6.1.1.1.2	Non-standby status.	80
3.2.1.6.1.1.2	Secondary alerts.	80
3.2.1.6.1.2	Local control and display features.	81
3.2.1.6.2	DME/P.	81
3.2.1.6.2.1	Responses to executive monitor inputs.	81
3.2.1.6.2.1.1	Integrity alarms.	81

3.2.1.6.2.1.1.1 Standby status.	82
3.2.1.6.2.1.1.2 Non-standby status.	82
3.2.1.6.2.2 Local control and display features.	83
3.2.1.6.3 MLS Control.	83
3.2.1.6.3.1 Control actions.	83
3.2.1.6.3.2 Control modes.	83
3.2.1.6.3.3 Control mastership.	84
3.2.1.6.3.4 Coordination principles and procedures.	84
3.2.1.6.3.5 Operating modes, states, and allowable com- mands.	86
3.2.1.6.3.5.1 Normal Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.	87
3.2.1.6.3.5.2 Normal Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.	87
3.2.1.6.3.5.3 Normal Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.	87
3.2.1.6.3.5.4 Normal Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.5 Normal Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.6 Normal Back Azimuth: On, Primary, No In- tegrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.7 Normal Back Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.8 Normal Back Azimuth: Off, Secondary, In- tegrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.9 Normal Back Azimuth: Off, Primary, No In- tegrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.10 Normal Back Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.11 Normal Azimuth: Reconfigure.	91
3.2.1.6.3.5.12 Test Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.13 Test Azimuth: On, Primary, Integrity Alarms, Monitor Bypass.	92
3.2.1.6.3.5.14 Test Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.	92
3.2.1.6.3.5.15 Test Azimuth: On, Secondary, Integrity Alarms, Monitor Bypass.	92
3.2.1.6.3.5.16 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.	93
3.2.1.6.3.5.17 Test Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.	93
3.2.1.6.3.5.18 Test Azimuth: Off, Primary, Integrity Alarms, Monitor Bypass.	93
3.2.1.6.3.5.19 Test Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.	93
3.2.1.6.3.5.20 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Bypass.	93
3.2.1.6.3.5.21 Test Back Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.	94

3.2.1.6.2.1.1.1 Standby status.	82
3.2.1.6.2.1.1.2 Non-standby status.	82
3.2.1.6.2.2 Local control and display features.	83
3.2.1.6.3 MLS Control.	83
3.2.1.6.3.1 Control actions.	83
3.2.1.6.3.2 Control modes.	83
3.2.1.6.3.3 Control mastership.	84
3.2.1.6.3.4 Coordination principles and procedures.	84
3.2.1.6.3.5 Operating modes, states, and allowable com- mands.	86
3.2.1.6.3.5.1 Normal Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.	87
3.2.1.6.3.5.2 Normal Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.	87
3.2.1.6.3.5.3 Normal Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.	87
3.2.1.6.3.5.4 Normal Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.5 Normal Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.6 Normal Back Azimuth: On, Primary, No In- tegrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.7 Normal Back Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.	90
3.2.1.6.3.5.8 Normal Back Azimuth: Off, Secondary, In- tegrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.9 Normal Back Azimuth: Off, Primary, No In- tegrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.10 Normal Back Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.11 Normal Azimuth: Reconfigure.	91
3.2.1.6.3.5.12 Test Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.	91
3.2.1.6.3.5.13 Test Azimuth: On, Primary, Integrity Alarms, Monitor Bypass.	92
3.2.1.6.3.5.14 Test Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.	92
3.2.1.6.3.5.15 Test Azimuth: On, Secondary, Integrity Alarms, Monitor Bypass.	92
3.2.1.6.3.5.16 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.	93
3.2.1.6.3.5.17 Test Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.	93
3.2.1.6.3.5.18 Test Azimuth: Off, Primary, Integrity Alarms, Monitor Bypass.	93
3.2.1.6.3.5.19 Test Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.	93
3.2.1.6.3.5.20 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Bypass.	93
3.2.1.6.3.5.21 Test Back Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.	94

3.2.1.6.3.5.48 Test Approach Elevation: Off, Secondary, Integrity Alarms, Monitor Bypass.	102
3.2.1.6.3.5.49 Test Offline Elevation: Off, Secondary, Integrity Alarms, Monitor Normal.	103
3.2.1.6.3.5.50 Test Offline Elevation: Off, Primary, No Integrity Alarms, Monitor Normal.	103
3.2.1.6.3.5.51 Test Offline Elevation: Off, Primary, Integrity Alarms, Monitor Bypass.	103
3.2.1.6.3.5.52 Test Offline Elevation: Off, Secondary, No Integrity Alarms, Monitor Normal.	103
3.2.1.6.3.5.53 Test Offline Elevation: Off, Secondary, Integrity Alarms, Monitor Bypass.	104
3.2.1.6.3.5.54 Test Approach Elevation: Reconfigure. . .	104
3.2.1.6.3.5.55 Normal Approach DME/P: On (IA and FA), Primary, No Integrity Alarms, Monitor Normal. . . .	104
3.2.1.6.3.5.56 Normal Approach DME/P: On (IA and FA), Secondary, No Integrity Alarms, Monitor Normal. . .	104
3.2.1.6.3.5.57 Normal Approach DME/P: On (IA only), Secon- dary, FA Integrity Alarms, Monitor Normal.	105
3.2.1.6.3.5.58 Normal Approach DME/P: Off, Secondary, Integrity Alarms, Monitor Normal.	105
3.2.1.6.3.5.59 Normal Approach DME/P: Off, Primary, No Integrity Alarms, Monitor Normal.	105
3.2.1.6.3.5.60 Normal Approach DME/P: Off, Secondary, No Integrity Alarms, Monitor Normal.	108
3.2.1.6.3.5.61 Normal Offline DME/P: Off, Secondary, Integrity Alarms, Monitor Normal.	108
3.2.1.6.3.5.62 Normal Offline DME/P: Off, Primary, No Integrity Alarms, Monitor Normal.	108
3.2.1.6.3.5.63 Normal Offline DME/P: Off, Secondary, No Integrity Alarms, Monitor Normal.	108
3.2.1.6.3.5.64 Normal DME/P: Reconfigure.	108
3.2.1.6.3.5.65 Test Approach DME/P: On (IA and FA), Pri- mary, No Integrity Alarms, Monitor Normal.	109
3.2.1.6.3.5.66 Test Approach DME/P: On (IA and FA), Pri- mary, Integrity Alarms, Monitor Bypass.	109
3.2.1.6.3.5.67 Test Approach DME/P: On (IA and FA), Secon- dary, No Integrity Alarms, Monitor Normal.	109
3.2.1.6.3.5.68 Test Approach DME/P: On (IA and FA), Secon- dary, Integrity Alarms, Monitor Bypass.	110
3.2.1.6.3.5.69 Test Approach DME/P: On (IA only), Secon- dary, FA Integrity Alarms, Monitor Normal.	110
3.2.1.6.3.5.70 Test Approach DME/P: On (IA only), Secon- dary, FA Integrity Alarms, Monitor Bypass.	110
3.2.1.6.3.5.71 Test Approach DME/P: Off, Secondary, In- tegrity Alarms, Monitor Normal.	111
3.2.1.6.3.5.72 Test Approach DME/P: Off, Primary, No Integrity Alarms, Monitor Normal.	111
3.2.1.6.3.5.73 Test Approach DME/P: Off, Primary, Integrity Alarms, Monitor Bypass.	111

3.2.1.6.3.5.74 Test Approach DME/P: Off, Secondary, No Integrity Alarms, Monitor Normal.	111
3.2.1.6.3.5.75 Test Approach DME/P: Off, Secondary, Integrity Alarms, Monitor Bypass.	112
3.2.1.6.3.5.76 Test Offline DME/P: Off, Secondary, Integrity Alarms, Monitor Normal.	112
3.2.1.6.3.5.77 Test Offline DME/P: Off, Primary, No Integrity Alarms, Monitor Normal.	112
3.2.1.6.3.5.78 Test Offline DME/P: Off, Primary, Integrity Alarms, Monitor Bypass.	112
3.2.1.6.3.5.79 Test Offline DME/P: Off, Secondary, No Integrity Alarms, Monitor Normal.	112
3.2.1.6.3.5.80 Test Offline DME/P: Off, Secondary, Integrity Alarms, Monitor Bypass.	113
3.2.1.6.3.5.81 Test DME/P: Reconfigure.	113
3.2.1.6.3.5.82 No REU State.	113
3.2.1.6.4 Equipment Status Verification.	113
3.2.1.6.4.1 End-to-End Integrity Checks.	114
3.2.1.6.4.2 Automatic Integrity Checks.	114
3.2.1.6.4.3 Category Status Checks.	119
3.2.1.7 Executive Monitor.	119
3.2.1.7.1 Azimuth/elevation.	119
3.2.1.7.1.1 Executive monitor general requirements.	119
3.2.1.7.1.2 Executive monitor specific requirements.	120
3.2.1.7.2 DME/P.	120
3.2.1.7.2.1 Executive monitor general requirements.	120
3.2.1.7.2.2 Executive monitor specific requirements.	121
3.2.1.8 Remote Monitoring Subsystem (RMS).	122
3.2.1.8.1 Functional Requirements.	122
3.2.1.8.2 Data Requirements.	122
3.2.1.8.2.1 Monitored Parameters.	122
3.2.1.8.2.2 Equipment Status.	128
3.2.1.8.2.3 Sampling Rates.	128
3.2.1.8.2.4 Hard/Soft Alarm Thresholds.	128
3.2.1.8.2.5 Historical Performance Records.	128
3.2.1.8.2.6 Basic and Auxiliary Data Words.	128
3.2.1.8.3 Data Processing.	128
3.2.1.8.3.1 Hard/Soft Alarm Determination.	129
3.2.1.8.3.2 Return To Normal Determination.	129
3.2.1.8.3.3 Change of State Determination.	131
3.2.1.8.3.4 Fault Diagnostics.	131
3.2.1.8.3.5 Record of Events.	132
3.2.1.8.3.6 Timestamping.	132
3.2.1.8.4 RMS/RMMS Operational Interface.	132
3.2.1.8.4.1 RMS Message Generation.	132
3.2.1.8.4.2 RMS Messages.	132
3.2.1.8.4.2.1 Alarm Message.	132
3.2.1.8.4.2.2 Return to Normal Message.	132
3.2.1.8.4.2.3 State Change Message.	133
3.2.1.8.4.2.4 Terminal Message.	133
3.2.1.8.4.2.5 Control messages.	133

3.2.1.8.4.2.5.1 Maintenance Control Granted.	133
3.2.1.8.4.2.5.2 Maintenance control denied.	133
3.2.1.8.4.2.6 Command Error Message.	133
3.2.1.8.4.2.7 Busy Status Message.	135
3.2.1.8.4.2.8 Site Data Report Message.	135
3.2.1.8.4.2.8.1 End-to-End Integrity Check Results.	135
3.2.1.8.4.2.8.2 Automatic Integrity Check Results.	135
3.2.1.8.4.2.8.3 Diagnostics Results.	135
3.2.1.8.4.3 Message Priority.	136
3.2.1.8.4.4 Not Used.	136
3.2.1.8.4.5 RMS Command Processing.	136
3.2.1.8.4.5.1 Equipment On.	137
3.2.1.8.4.5.2 Equipment Off.	137
3.2.1.8.4.5.3 Redesignate Primary Equipment.	137
3.2.1.8.4.5.4 Initiate Equipment Restart.	137
3.2.1.8.4.5.5 Runway Reconfigure.	137
3.2.1.8.4.5.6 RMS Security Access Change.	137
3.2.1.8.4.5.7 RMS Reset.	137
3.2.1.8.4.5.8 Initiate Monitor Bypass.	137
3.2.1.8.4.5.9 Return Monitor to Normal.	138
3.2.1.8.4.5.10 Initiate End-To-End Integrity Check.	138
3.2.2 Internal MLS interfaces.	138
3.2.2.1 Station-to-Station and REU-to-Station interfaces.	139
3.2.2.1.1 Single design operation	139
3.2.2.1.2 Multiple design interoperability.	140
3.2.2.1.2.1 Dual REU configuration.	140
3.2.2.1.2.2 REU to REU communications.	142
3.2.2.2 REU/RCSU Panel/RSU interfaces.	142
3.2.3 External MLS Communication Interfaces.	143
3.2.3.1 Remote Maintenance Monitoring System (RMMS) Com- munications Interface.	143
3.2.3.1.1 RMMS EIA-232 port.	143
3.2.3.2 Auxiliary data word communications.	144
3.2.3.3 Portable Maintenance Data Terminal (PMDT).	145
3.2.3.3.1 PMDT Operation.	145
3.2.3.3.2 RMS/PMDT Physical Interface.	145
3.2.3.3.3 Data Transmission and Display.	146
3.2.4 Physical Characteristics.	146
3.2.4.1 Protective coatings.	146
3.2.5 System Quality Factors.	147
3.2.5.1 Reliability.	147
3.2.5.1.1 Not Used.	147
3.2.5.1.2 Switching devices.	148
3.2.5.1.3 Not Used.	148
3.2.5.1.4 Not Used.	148
3.2.5.1.5 Category II and III equipment.	148
3.2.5.1.5.1 Category II equipment.	148
3.2.5.1.5.1.1 Category II continuity of service.	148
3.2.5.1.5.1.2 Category II integrity.	148
3.2.5.1.5.2 Category III equipment.	150
3.2.5.1.5.2.1 Category III continuity of service.	150

3.2.1.8.4.2.5.1 Maintenance Control Granted.	133
3.2.1.8.4.2.5.2 Maintenance control denied.	133
3.2.1.8.4.2.6 Command Error Message.	133
3.2.1.8.4.2.7 Busy Status Message.	135
3.2.1.8.4.2.8 Site Data Report Message.	135
3.2.1.8.4.2.8.1 End-to-End Integrity Check Results.	135
3.2.1.8.4.2.8.2 Automatic Integrity Check Results.	135
3.2.1.8.4.2.8.3 Diagnostics Results.	135
3.2.1.8.4.3 Message Priority.	136
3.2.1.8.4.4 Not Used.	136
3.2.1.8.4.5 RMS Command Processing.	136
3.2.1.8.4.5.1 Equipment On.	137
3.2.1.8.4.5.2 Equipment Off.	137
3.2.1.8.4.5.3 Redesignate Primary Equipment.	137
3.2.1.8.4.5.4 Initiate Equipment Restart.	137
3.2.1.8.4.5.5 Runway Reconfigure.	137
3.2.1.8.4.5.6 RMS Security Access Change.	137
3.2.1.8.4.5.7 RMS Reset.	137
3.2.1.8.4.5.8 Initiate Monitor Bypass.	137
3.2.1.8.4.5.9 Return Monitor to Normal.	138
3.2.1.8.4.5.10 Initiate End-To-End Integrity Check.	138
3.2.2 Internal MLS interfaces.	138
3.2.2.1 Station-to-Station and REU-to-Station interfaces.	139
3.2.2.1.1 Single design operation	139
3.2.2.1.2 Multiple design interoperability.	140
3.2.2.1.2.1 Dual REU configuration.	140
3.2.2.1.2.2 REU to REU communications.	142
3.2.2.2 REU/RCSU Panel/RSU interfaces.	142
3.2.3 External MLS Communication Interfaces.	143
3.2.3.1 Remote Maintenance Monitoring System (RMMS) Com- munications Interface.	143
3.2.3.1.1 RMMS EIA-232 port.	143
3.2.3.2 Auxiliary data word communications.	144
3.2.3.3 Portable Maintenance Data Terminal (PMDT).	145
3.2.3.3.1 PMDT Operation.	145
3.2.3.3.2 RMS/PMDT Physical Interface.	145
3.2.3.3.3 Data Transmission and Display.	146
3.2.4 Physical Characteristics.	146
3.2.4.1 Protective coatings.	146
3.2.5 System Quality Factors.	147
3.2.5.1 Reliability.	147
3.2.5.1.1 Not Used.	147
3.2.5.1.2 Switching devices.	148
3.2.5.1.3 Not Used.	148
3.2.5.1.4 Not Used.	148
3.2.5.1.5 Category II and III equipment.	148
3.2.5.1.5.1 Category II equipment.	148
3.2.5.1.5.1.1 Category II continuity of service.	148
3.2.5.1.5.1.2 Category II integrity.	148
3.2.5.1.5.2 Category III equipment.	150
3.2.5.1.5.2.1 Category III continuity of service.	150

3.3.4 Workmanship.	166
3.3.4.1 General Equipment Requirements.	166
3.3.4.1.1 Modular construction.	166
3.3.4.1.1.1 Printed wiring boards.	166
3.3.4.1.2 LRU Level.	167
3.3.4.1.3 Solid state design.	167
3.3.4.1.4 Site configuration.	167
3.3.4.1.5 Accessibility.	167
3.3.4.1.6 Test provisions.	168
3.3.4.1.7 Panel controls.	168
3.3.4.1.8 Real Time Clock.	168
3.3.4.2 Software development.	168
3.3.4.2.1 Programming Requirement.	168
3.3.4.2.1.1 Programming Language.	168
3.3.4.2.1.2 Compilers and Assemblers.	168
3.3.4.2.1.3 Operating System.	169
3.3.4.2.1.3.1 Operating System Augmentation.	169
3.3.4.2.1.4 Design and Coding Constraints.	169
3.3.4.3 Physical structures.	169
3.3.4.3.1 Antenna support material and design.	169
3.3.4.3.1.1 Life cycle.	171
3.3.4.3.1.2 Foundations and concrete structures.	171
3.3.4.3.2 Scanning Beam Antenna enclosures and mounting structures.	173
3.3.4.3.3 Walk-in Equipment Enclosures.	173
3.3.4.4 Processes.	174
3.3.5 Interchangeability.	174
3.3.5.1 Hardware interchangeability.	174
3.3.5.2 Software interchangeability.	174
3.3.6 Safety.	175
3.3.6.1 Transient protection.	175
3.3.6.2 Grounding requirements.	175
3.3.6.3 Obstruction lights.	175
3.3.6.4 Low Impact Resistance Structures (LIRS).	176
3.3.6.5 Personnel Safety	176
3.3.6.6 Lightning Protection.	177
3.3.7 Human Engineering.	177
3.3.8 Nuclear Control.	177
3.3.9 System Security.	177
3.3.9.1 Physical Security.	177
3.3.9.2 PMDT Security.	177
3.3.9.2.1 Passwords and user identifiers.	177
3.3.9.2.2 Log-on Sequence.	178
3.3.9.2.2.1 Levels of Security.	178
3.3.10 Government Furnished Property Usage.	178
3.3.10.1 MPS simulator.	178
3.3.11 Computer Resource Reserve Capacity.	179
3.3.11.1 Memory.	179
3.3.11.1.1 Memory utilization.	179
3.3.11.1.2 Memory Growth.	179
3.3.11.2 Processing speed.	180

3.3.11.3 Port Requirements.	181
3.4 DOCUMENTATION.	181
3.4.1 Documentation to be furnished.	181
3.4.1.1 Configuration management.	181
3.4.2 Drawings.	182
3.4.3 Instruction books.	182
3.5 NATIONAL AIRSPACE INTEGRATED LOGISTICS SUPPORT (NAILS). . .	182
3.5.1 Maintenance.	183
3.5.1.1 Maintenance planning.	183
3.5.1.1.1 On-site.	183
3.5.1.1.2 Spare LRUs.	183
3.5.1.2 Test equipment.	184
3.5.1.2.1 Common test equipment.	184
3.5.1.2.2 Special test equipment.	184
3.5.1.2.2.1 Duty, test equipment.	187
3.5.1.3 Support equipment.	187
3.5.1.3.1 Special test adapters for automatic test equip- ment (ATE).	187
3.5.1.3.2 Special test adapters for nonautomatic test equipment.	187
3.5.1.3.3 Special tools.	188
3.5.2 Supply System Requirements.	188
3.6 PERSONNEL AND TRAINING.	188
3.6.1 Personnel.	188
3.6.2 Training.	188
3.7 CHARACTERISTICS OF SUBORDINATE ELEMENTS.	188
3.8 PRECEDENCE.	188
3.9 QUALIFICATION.	188
3.10 STANDARD SAMPLE.	188
3.11 PREPRODUCTION SAMPLE, PERIODIC PRODUCTION SAMPLE, PILOT OR PILOT LOT.	188
4 QUALITY ASSURANCE PROVISIONS.	189
4.1 RESPONSIBILITY FOR INSPECTION.	189
4.2 SPECIAL TESTS AND EXAMINATIONS.	189
4.2.1 General.	189
4.2.1.1 Detailed requirements.	189
4.2.1.1.1 Not Used.	189
4.2.1.1.2 Reliability test.	189
4.2.1.1.2.1 Reliability growth tests (RGT).	190
4.2.1.1.2.2 Reliability demonstration test (RDT).	191
4.2.1.1.2.3 Configuration control.	191
4.2.1.1.2.4 Equipment to be subjected to reliability testing.	192
4.2.1.1.2.5 Test implementation and conditions.	192
4.2.1.1.2.5.1 In-Plant tests.	192
4.2.1.1.2.5.2 Field testing.	193
4.2.1.1.2.6 Failure count and assignment.	194
4.2.1.1.2.7 Accept/reject criteria.	194
4.2.1.1.2.7.1 Critical failures.	194
4.2.1.1.2.7.2 General consideration.	194

3.3.11.3 Port Requirements.	181
3.4 DOCUMENTATION.	181
3.4.1 Documentation to be furnished.	181
3.4.1.1 Configuration management.	181
3.4.2 Drawings.	182
3.4.3 Instruction books.	182
3.5 NATIONAL AIRSPACE INTEGRATED LOGISTICS SUPPORT (NAILS). . .	182
3.5.1 Maintenance.	183
3.5.1.1 Maintenance planning.	183
3.5.1.1.1 On-site.	183
3.5.1.1.2 Spare LRUs.	183
3.5.1.2 Test equipment.	184
3.5.1.2.1 Common test equipment.	184
3.5.1.2.2 Special test equipment.	184
3.5.1.2.2.1 Duty, test equipment.	187
3.5.1.3 Support equipment.	187
3.5.1.3.1 Special test adapters for automatic test equip- ment (ATE).	187
3.5.1.3.2 Special test adapters for nonautomatic test equipment.	187
3.5.1.3.3 Special tools.	188
3.5.2 Supply System Requirements.	188
3.6 PERSONNEL AND TRAINING.	188
3.6.1 Personnel.	188
3.6.2 Training.	188
3.7 CHARACTERISTICS OF SUBORDINATE ELEMENTS.	188
3.8 PRECEDENCE.	188
3.9 QUALIFICATION.	188
3.10 STANDARD SAMPLE.	188
3.11 PREPRODUCTION SAMPLE, PERIODIC PRODUCTION SAMPLE, PILOT OR PILOT LOT.	188
4 QUALITY ASSURANCE PROVISIONS.	189
4.1 RESPONSIBILITY FOR INSPECTION.	189
4.2 SPECIAL TESTS AND EXAMINATIONS.	189
4.2.1 General.	189
4.2.1.1 Detailed requirements.	189
4.2.1.1.1 Not Used.	189
4.2.1.1.2 Reliability test.	189
4.2.1.1.2.1 Reliability growth tests (RGT).	190
4.2.1.1.2.2 Reliability demonstration test (RDT).	191
4.2.1.1.2.3 Configuration control.	191
4.2.1.1.2.4 Equipment to be subjected to reliability testing.	192
4.2.1.1.2.5 Test implementation and conditions.	192
4.2.1.1.2.5.1 In-Plant tests.	192
4.2.1.1.2.5.2 Field testing.	193
4.2.1.1.2.6 Failure count and assignment.	194
4.2.1.1.2.7 Accept/reject criteria.	194
4.2.1.1.2.7.1 Critical failures.	194
4.2.1.1.2.7.2 General consideration.	194

4.3.2.1.1	Hardware.	210
4.3.2.1.2	Software.	210
4.3.2.2	Test.	210
4.3.2.2.1	Hardware.	210
4.3.2.2.2	Software.	210
4.3.2.3	Demonstration.	210
4.3.2.3.1	Hardware.	211
4.3.2.3.2	Software.	211
4.3.2.4	Analysis.	211
4.3.2.4.1	Hardware.	211
4.3.2.4.1.1	Engineering Analysis.	211
4.3.2.4.1.2	Similarity Analysis.	211
4.3.2.4.1.3	Validation of Records Analysis.	211
4.3.2.4.2	Software.	212
5	PREPARATION FOR DELIVERY.	213
5.1	Preservation, packaging, packing, and marking.	213
5.2	Transportation.	214
6	NOTES.	215
6.1	INTENDED USE.	215
6.1.1	Missions.	215
6.1.2	Threat.	215
6.2	Acronyms.	215

LIST OF FIGURES

FIGURE 1 STRUCTURE OF MLS GROUND SYSTEM	3
FIGURE 2 POWER INTERFACES	35
FIGURE 3 DME/P PULSE ENVELOPE	56
FIGURE 4 EXPANSION TO INCLUDE PULSE SHAPE BELOW 5%	57
FIGURE 5 STRUCTURE OF MULTIPLE DESIGN MLS GROUND SYSTEM	141
FIGURE 6 MINIMUM MEASUREMENT POINTS TO VERIFY COMPLIANCE WITH ERP REQUIREMENTS (AZIMUTH/ELEVATION)	201
FIGURE 7 MINIMUM MEASUREMENT POINTS TO VERIFY COMPLIANCE WITH ERP REQUIREMENTS (DME/P)	207
FIGURE A-1 VIRTUAL ORIGIN	A-10

LIST OF FIGURES

FIGURE 1 STRUCTURE OF MLS GROUND SYSTEM	3
FIGURE 2 POWER INTERFACES	35
FIGURE 3 DME/P PULSE ENVELOPE	56
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FIGURE 7 MINIMUM MEASUREMENT POINTS TO VERIFY COMPLIANCE WITH ERP REQUIREMENTS (DME/P)	207
FIGURE A-1 VIRTUAL ORIGIN	A-10

APPENDIXES

10	DEFINITIONS.	A-1
20	CHARACTERISTICS OF AIRBORNE DME/P INTERROGATOR.. . . .	B-1
30	VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM).	C-1

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30	VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM).	C-1

1 SCOPE.

1.1 IDENTIFICATION. This System Specification establishes the performance, design, development, and test requirements for the Microwave Landing System (MLS) Ground System. The MLS Ground System includes azimuth equipment; elevation equipment; Precision Distance Measuring Equipment (DME/P); antennas; structures to house the azimuth, elevation and DME/P equipment; Remote Control and Status Unit (RCSU) and Remote Status Unit (RSU). This specification also provides requirements for Special Test Equipment.

1.2 SYSTEM OVERVIEW.

MLS Ground System, in support of the National Airspace System (NAS) Plan, provides final approach position information to aircraft in all weather conditions. Coverage begins at a range of 20 nmi and an altitude up to 20,000 ft. within up to $\pm 60^\circ$ of runway centerline. The actual coverage envelope is determined by the topography in the approach region. Additionally, position information may be provided to departing aircraft and aircraft executing missed approaches in the back azimuth region (the direction opposite the approach azimuth). In a precision approach, position information is provided in three dimensions, range, azimuth and elevation. Azimuth and elevation information are provided through the use of two scanning beams, one sweeping horizontally and the other vertically. The time differential between the beam center of two successive sweeps of each beam is then used to calculate the appropriate angle information, i.e., angle off azimuth boresight or angle above elevation boresight. All angle calculations are performed in the avionics equipment installed on the aircraft. In a non-precision approach, position information is provided in two dimensions, range and azimuth. Additionally, information about the runway is provided by the transmission of digital data. The information provided includes, but is not limited to, runway orientation, MLS configuration (approach only or approach/back azimuth), and datum information for position calculations. System maintenance relies heavily on fault diagnostics and built-in-test which either run automatically in the event of fault or controlled manually through either a portable Maintenance Data Terminal (PMDT) or the FAA's Maintenance Processing Subsystem (MPS) (Appendix A). Figure 1 provides the terminology and depicts the functional relationships among the major equipment items that comprise the MLS Ground System. MLS Ground Systems procured under this specification are installed as one of two configurations: Category II or Category III.

1.2.1 Category II MLS. A Category II MLS configuration is one in which the course information provided by the MLS intersects the glide path at a height of 50 ft (15 m) or less at the runway threshold. The signal transmitted by a Category II MLS is identical to that transmitted by a Category III MLS in both format and coverage. The only difference between the two configurations is the availability of standby equipment, which a Category II configuration does not have. A Category II configuration can be converted to a Category III configuration through the installation of a Category III Conversion kit.

1.2.2 Category III MLS. A Category III MLS configuration is one in which the MLS guidance information is provided to, and along, the runway surface. A Category III configuration has standby equipment available to ensure there is no loss of guidance signal.

1.3 DOCUMENT OVERVIEW.

This specification defines requirements that are applicable to the Microwave Landing System (MLS) Ground System to be furnished by the contractor. This includes general performance requirements in areas such as modularity, integrity, continuity of service (Appendix A), electromagnetic compatibility, reliability, maintainability and testability. Requirements are also included for software and firmware, for all equipment interfaces, and for the Remote Monitoring Subsystem (RMS).

FAA-STD-022 provides signal-in-space requirements for Azimuth, Elevation and Data functions.

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FAA-STD-022 provides signal-in-space requirements for Azimuth, Elevation and Data functions.

FAA-E-2721B
August 30, 1990

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2 APPLICABLE DOCUMENTS.

2.1 GOVERNMENT DOCUMENTS.

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement, except for standard FAA-STD-022 listed below. FAA-STD-022 shall have precedence over this specification as stated in 3.8.

2.1.1 Specifications.

Federal:

FAA:

FAA-E-910G Amendment 1 January 24, 1974	Structural Steel
FAA-C-1217D August 16, 1977	Electrical Work, Interior
FAA-G-2100E SCN 1 March 11, 1987	Electronic Equipment, General Requirements
FAA-D-2494B March 14, 1984	Technical Instruction Book Manuscript: Electronic, Electrical, and Mechanical Equipment, Requirements for Preparation of Manuscript and Production of Books
FAA-E-2721/15	MICROWAVE LANDING SYSTEM GROUND EQUIPMENT, Turnkey Facility Establishment

Note: The effective date and revision of FAA-E-2721/15 will be that in effect on the date of RFP release

FAA-ER-530-81-04 December 1, 1982	Structural/Mechanical Design Requirements for Low Impact Resistance Microwave Landing System Structures (MLS/LIRS)
FAA-E-2761A March 14, 1988	Cable, Fiber Optic, Multi-mode, Multifiber, Specification

Military:

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FAA-E-2761A March 14, 1988	Cable, Fiber Optic, Multi-mode, Multifiber, Specification

Military:

FAA-STD-003
Amendment 1
July 31, 1972

Paint Systems for Structures

FAA-STD-019A
August 16, 1985

Lightning Protection, Grounding,
Bonding, and Shielding Require-
ments of Facilities

FAA-STD-020A
September 26, 1985

Transient Protection Grounding,
Bonding, and Shielding Requirement
for Equipment

FAA-STD-022

Microwave Landing System (MLS)
Interoperability and Performance
Requirements

Note: The effective date and revision of FAA-STD-022 will be that in effect on the date of RFP release

FAA-STD-025B
October 29, 1987

Preparation of Interface Control
Documentation

Military:

DOD-STD-2167A
February 29, 1988

Defense System Software Develop-
ment

MIL-STD-129K
June 1, 1988

Marking for Shipment and Storage

MIL-STD-130G
October 11, 1988

Identification Marking of U.S.
Military Property

MIL-STD-280A
Notice 1
July 7, 1969

Definitions of Item Levels, Item
Interchangeability, Models and
Other Related Items

MIL-STD-4541
Notice 1
February 16, 1989

Standard General Requirements for
Electronic Equipment

MIL-STD-461C
Notice 1
April 10, 1987

Electromagnetic Emission and Sus-
ceptibility Requirements for the
Control of Electromagnetic Inter-
ference

MIL-STD-462
Notice 6
October 15, 1987

Electromagnetic Interference Char-
acteristics, Measurement of.

FAA-STD-003
Amendment 1
July 31, 1972

Paint Systems for Structures

FAA-STD-019A
August 16, 1985

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FAA-STD-020A
September 26, 1985

Transient Protection Grounding,
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for Equipment

FAA-STD-022

Microwave Landing System (MLS)
Interoperability and Performance
Requirements

Note: The effective date and revision of FAA-STD-022 will be that in effect on the date of RFP release

FAA-STD-025B
October 29, 1987

Preparation of Interface Control
Documentation

Military:

DOD-STD-2167A
February 29, 1988

Defense System Software Develop-
ment

MIL-STD-129K
June 1, 1988

Marking for Shipment and Storage

MIL-STD-130G
October 11, 1988

Identification Marking of U.S.
Military Property

MIL-STD-280A
Notice 1
July 7, 1969

Definitions of Item Levels, Item
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MIL-STD-4541
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MIL-STD-462
Notice 6
October 15, 1987

Electromagnetic Interference Char-
acteristics, Measurement of.

MIL-STD-1521B Notice 1 December 19, 1985	Technical Reviews and Audits for Systems, Equipments, and Computer Software
MIL-STD-1561B November 17, 1984	Uniform Department of Defense Provisioning Procedures
MIL-STD-1629A Notice 2 November 28, 1984	Procedures for Performing a Fail- ure Mode Effects and Criticality Analysis
MIL-STD-1815A January 22, 1983	Ada Programming Language
MIL-STD-2165 January 26, 1985	Testability Program for Electronic Systems and Equipments

Other Government Agency

Title 29, Chapter XVII, Part 1910, July 1, 1985	Occupational Safety and Health Standards (Department of Labor)
--	---

2.1.3 Drawings.

(Where detailed drawings referred to in a specification are listed on an assembly drawing, it is only necessary to list the assembly drawing.)

2.1.4 Other Publications.

FAA Orders:

FAA Order 6000.30 January 5, 1982	Policy for Maintenance of the National Airspace System (NAS)
FAA Order 6980.26 June 1983	Battery Backup Power Systems - Theory and Selection Guidelines
FAA Order 3900.19A July 1982	Occupational Safety and Health

Handbooks:

MIL-HDBK-472 Notice 1 January 12, 1984	Maintainability Prediction
MIL-HDBK-781 July 14, 1987	Reliability Test Methods, Plans, and Environments for Engineering Development, Qualification, and Production

Bulletins:

FAA-E-2721B
August 30, 1990

Advisory Circular 70/7460-
1G
October 1985

Obstruction Marking and Lighting

Advisory Circular 150/5345-
1Q
January 23, 1986

Approved Airport Lighting Equip-
ment

Other:

DOT/FAA/SA-89/2

Microwave Landing System (MLS)
Multiple System Design Inter-
operability Interface Control
Report

Note: The effective date and revision of DOT/FAA/SA-89/2 will be that in effect on the date of RFP release

DOT/FAA/PS-89/2

Microwave Landing System Remote
Monitoring Subsystem/Remote Main-
tenance Monitoring System Inter-
face Control Report

Note: The effective date and revision of DOT/FAA/PA-89/2 will be that in effect on the date of RFP release

NAS-MD-790

Remote Maintenance Monitoring
System Interface Control Document,
Maintenance Processor Subsystem to
Remote Monitoring Subsystem and
Remote Monitoring Subsystem Con-
centrators

Note: The effective date and revision of NAS-MD-790 will be that in effect on the date of RFP release

NAS-MD-792
October 10, 1988

Operational Requirements for the
Remote Maintenance Monitoring
System (RMMS)

NAS-MD-793
February 28, 1986

Remote Maintenance Monitoring
System Functional Requirements for
the Remote Monitoring Subsystem

2.2 NON-GOVERNMENT DOCUMENTS. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

FAA-E-2721B
August 30, 1990

Advisory Circular 70/7460-
1G
October 1985

Obstruction Marking and Lighting

Advisory Circular 150/5345-
1Q
January 23, 1986

Approved Airport Lighting Equip-
ment

Other:

DOT/FAA/SA-89/2

Microwave Landing System (MLS)
Multiple System Design Inter-
operability Interface Control
Report

Note: The effective date and revision of DOT/FAA/SA-89/2 will be that in effect on the date of RFP release

DOT/FAA/PS-89/2

Microwave Landing System Remote
Monitoring Subsystem/Remote Main-
tenance Monitoring System Inter-
face Control Report

Note: The effective date and revision of DOT/FAA/PA-89/2 will be that in effect on the date of RFP release

NAS-MD-790

Remote Maintenance Monitoring
System Interface Control Document,
Maintenance Processor Subsystem to
Remote Monitoring Subsystem and
Remote Monitoring Subsystem Con-
centrators

Note: The effective date and revision of NAS-MD-790 will be that in effect on the date of RFP release

NAS-MD-792
October 10, 1988

Operational Requirements for the
Remote Maintenance Monitoring
System (RMMS)

NAS-MD-793
February 28, 1986

Remote Maintenance Monitoring
System Functional Requirements for
the Remote Monitoring Subsystem

2.2 NON-GOVERNMENT DOCUMENTS. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

ANSI X3.64 1979	American National Standard Additional Controls for use with American National Standard Code for Information Interchange
ASTM D 3951 1988	Standard Practice for Commercial Packaging
RTCA/DO-177 July 1981	Minimum Operational Performance Standards for Microwave Landing System (MLS) Airborne Receiving Equipment
RTCA/DO-189 September 1985	Minimum Operational Performance Standards for Airborne Distance Measuring Equipment (DME) Operating Within the Radio Frequency Range of 960-1250 MHZ.
IEEE 488 1978	Standard Digital Interface for Programmable Instrumentation
ACI-318 1983	American Concrete Institute Standard Building Code Requirements for Reinforced Concrete

2.2.3 Drawings.

2.2.4 Other Publications.

ARINC 429-9 September 11, 1985	Digital Information Transfer System
NFPA No. 70 1984	National Electrical Code
ESD-TR-85-148	Derated Application of Parts for ESD Systems Development
NTIA Manual May 1989 as revised thru January 1990	Manual of Regulations and Procedures for Federal Radio Frequency Management
TR-NPL-000335 June 1986, Rev. 1 February 1987 Rev. 2 November 1987	Technical Reference, Voice Grade Special Access Service (Bellcore Publication)
Aluminum Association ED-33 1981	Engineering Data for Aluminum Structures

Aluminum Association WA-20
1984

Welding Aluminum

AWS D1.1
1986

American Welding Society Struc-
tural Welding Code

ACI-336.2R
1966

Suggested Design Procedure for
Combined Footings and MATS

AISC manual
1980

Manual of Steel Construction of
the AISC

(Copies of the FAA documents and other applicable FAA specifications, standards, directives, advisory circulars and drawings may be obtained from the Contracting Officer in the FAA Office issuing the Invitation for Bids or Request for Proposals. Requests should fully identify materials desired; i.e., specifications, standards, amendments and drawing numbers and dates. Requests should cite the Invitation for Bids, Request for Proposals, or the contract involved or other use to be made of the requested material.)

(Information on obtaining copies of Federal specifications and standards may be obtained from General Services Administration offices in Atlanta, Georgia; Auburn, Washington; Boston, Massachusetts; Chicago, Illinois; Denver, Colorado; Fort Worth, Texas; Kansas City, Missouri; Los Angeles, California; and Washington, D.C.)

(Single copies of military standards and specifications may be requested by mail or telephone from the U.S. Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120. For telephone requests call (215) 697-3321, 8 AM to 4:30 PM, Monday through Friday. Not more than 5 items may be ordered on the same request. The applicable Invitation for Bids, Request for Proposal or contract number should be cited.)

(Information on obtaining copies of the National Electrical Code may be obtained from the National Fire Protection Association, Battery March Park, Quincy, Massachusetts 02269.)

(Information on obtaining copies of EIA standards may be obtained from the Electronic Industries Association, Engineering Department, 200 Eye Street, N.W., Washington, D.C. 20006.)

(Information on obtaining copies of the IES Handbook may be obtained from the Illuminating Engineering Society, 1860 Broadway, New York, New York.)

(Information on obtaining copies of RTCA documents may be obtained from the Radio Technical Commission for Aeronautics, Suite 500, One McPherson Square, Washington, D.C. 20005)

(Information on obtaining copies of Department of Labor Standard, OSHA Safety and Health Title 29, Chapter XVII, Part 1910, can be obtained from

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(Information on obtaining copies of National Climatic Data Center documents may be obtained from The National Climatic Data Center, Federal Building, Ashville, North Carolina 28801.)

(Information on obtaining aerial photographs of airports can be obtained from the National Ocean Service, Map and Imagery Information Unit, Mail Code N/CG 2314, 6001 Executive Boulevard, Rockville, Maryland 20852).

(Information on obtaining ESD documents can be obtained from Defense Technical Information Center (DTIC), Building #5 Reference Section, Cameron Station, Alexandria, VA 22304-6145)

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(Information on obtaining ESD documents can be obtained from Defense Technical Information Center (DTIC), Building #5 Reference Section, Cameron Station, Alexandria, VA 22304-6145)

3 SYSTEM REQUIREMENTS.

3.1 SYSTEM DEFINITION.

The MLS includes the following major elements: Azimuth (AZ), Back Azimuth (BAZ), Elevation (EL), Precision Distance Measuring Equipment (DME/P) and Remote Control and Status Equipment. Back Azimuth information may be provided by an Azimuth Station at the opposite end of the runway from the portion of the Azimuth Station providing Approach Azimuth information.

3.1.1 Azimuth Station.

3.1.1.1 Azimuth equipment. The Azimuth equipment is analogous to an Instrument Landing System (ILS) localizer but has a much wider proportional guidance coverage. Consequently, it is possible for a single AZ to provide approach guidance to additional runways or helipads on the airport as well as to support segmented/curved approaches.

3.1.1.2 DME/P equipment. The Precision Distance Measuring Equipment provides continuous range information, in place of the station passage indications provided by the marker transmitters used with ILS. The DME/P has an accuracy of ± 100 feet in the final approach mode, as compared to the ± 1200 foot accuracy of the standard DME/N system.

3.1.1.3 Back Azimuth. The Back Azimuth Equipment is identical to the AZ. However, FAA installations with a BAZ will be those with a requirement for opposite-direction approaches. To provide this bi-directional capability, all FAA BAZ equipment will have a 20 NM range, and the AZ and BAZ equipments will interchange functions when the direction of runway operation is reversed. Bi-directional MLS facilities will have a separate DME/P and EL equipment for each direction of operation. Only one DME/P and EL equipment will be operational at a time.

3.1.1.4 Data Words. MLS facilities transmit two categories of data words, basic and auxiliary. The format is flexible; the data is in binary or alphanumeric (ASCII) and consists of a number of data words which can be supplemented as operational experience is gained.

Basic data words are transmitted at various rates and include station identification and the digital data needed by the receiver for processing the AZ, BAZ and EL angle functions.

Auxiliary data words include all data necessary to establish the geometry of the system for MLS area navigation and are also transmitted at various rates.

3.1.2 Elevation station.

3.1.2.1 Elevation equipment. The Elevation Station (EL) is analogous to the glide slope facility of the ILS. The EL provides for a wide range of glide path angles selectable by the pilot. The signal coverage of the EL extends through the area covered by the AZ, to provide precision guidance on any approach course within the Azimuth coverage volume.

3.1.3 Signal format. The MLS can operate on any one of 200 channels, from 5031 mHz to 5090.7 mHz, inclusive. This is expected to be adequate based on present projections of MLS deployment. In any MLS, the AZ, BAZ and EL equipments all transmit sequentially in different time slots on the same frequency. Basic and auxiliary data are also transmitted on the same frequency. The DME/P transmits on an L-band frequency paired with the MLS channel.

3.2 CHARACTERISTICS.

3.2.1 Performance Characteristics. The MLS Ground System is broken down into eight functional subsections for the listing of performance characteristics. These are: azimuth (AZ) equipment (guidance signals); elevation (EL) equipment (guidance signals); data transmissions; Precision Distance Measuring Equipment (DME/P); remote control and status monitoring; equipment control and status; Executive Monitor (EM) (Appendix A) and Remote Monitoring Subsystem (RMS). References to Back Azimuth (BAZ) apply to a second AZ equipment transmitting BAZ signals.

3.2.1.1 Azimuth equipment.

- (1) The azimuth equipment shall operate and provide the following functions required in accordance with FAA-STD-022: Approach Azimuth or High Rate Approach Azimuth, and Back Azimuth.
- (2) The conversion capability between functions shall be as specified in 3.2.1.1.11 thru 3.2.1.1.12.
- (3) Each Azimuth Equipment shall include the items listed below.
 - (a) Transmitter, power supplies, amplifier, executive monitor (Appendix A) (including integral monitor), beam steering unit and associated Local Control and Status Unit (LCSU).
 - (b) Azimuth scanning beam antenna, data antenna, and two general Out-of-Coverage Indicator (OCI) antennas (see 3.2.1.1.13.3), and all associated cables and waveguides.
 - (c) Walk-in enclosure and mounting structures.
 - (d) Field monitor antenna, supporting structures, electronics, and associated cables.
 - (e) Interstation communications media.

3.1.2.1 Elevation equipment. The Elevation Station (EL) is analogous to the glide slope facility of the ILS. The EL provides for a wide range of glide path angles selectable by the pilot. The signal coverage of the EL extends through the area covered by the AZ, to provide precision guidance on any approach course within the Azimuth coverage volume.

3.1.3 Signal format. The MLS can operate on any one of 200 channels, from 5031 mHz to 5090.7 mHz, inclusive. This is expected to be adequate based on present projections of MLS deployment. In any MLS, the AZ, BAZ and EL equipments all transmit sequentially in different time slots on the same frequency. Basic and auxiliary data are also transmitted on the same frequency. The DME/P transmits on an L-band frequency paired with the MLS channel.

3.2 CHARACTERISTICS.

3.2.1 Performance Characteristics. The MLS Ground System is broken down into eight functional subsections for the listing of performance characteristics. These are: azimuth (AZ) equipment (guidance signals); elevation (EL) equipment (guidance signals); data transmissions; Precision Distance Measuring Equipment (DME/P); remote control and status monitoring; equipment control and status; Executive Monitor (EM) (Appendix A) and Remote Monitoring Subsystem (RMS). References to Back Azimuth (BAZ) apply to a second AZ equipment transmitting BAZ signals.

3.2.1.1 Azimuth equipment.

- (1) The azimuth equipment shall operate and provide the following functions required in accordance with FAA-STD-022: Approach Azimuth or High Rate Approach Azimuth, and Back Azimuth.
- (2) The conversion capability between functions shall be as specified in 3.2.1.1.11 thru 3.2.1.1.12.
- (3) Each Azimuth Equipment shall include the items listed below.
 - (a) Transmitter, power supplies, amplifier, executive monitor (Appendix A) (including integral monitor), beam steering unit and associated Local Control and Status Unit (LCSU).
 - (b) Azimuth scanning beam antenna, data antenna, and two general Out-of-Coverage Indicator (OCI) antennas (see 3.2.1.1.13.3), and all associated cables and waveguides.
 - (c) Walk-in enclosure and mounting structures.
 - (d) Field monitor antenna, supporting structures, electronics, and associated cables.
 - (e) Interstation communications media.

TABLE 1 AZIMUTH PFE GROUND EQUIPMENT TOLERANCES

Vertical Angle (Degrees)	Horizontal Angle (Degrees)			
	-3< - >+3	±3	±40	±60
<u>1 Degree Beamwidth</u>				
0 - 4	±0.020	±0.040	±0.050	±0.060
9	±0.050	±0.060	±0.080	±0.120
15	±0.075	±0.090	±0.120	±0.180
<u>2 Degree Beamwidth</u>				
0 - 4	±0.030	±0.045	±0.080	
9	±0.060	±0.080	±0.120	
15	±0.090	±0.120	±0.180	
<u>3 Degree Beamwidth</u>				
0 - 4	±0.040	±0.060	±0.100	
9	±0.080	±0.100	±0.150	
15	±0.120	±0.150	±0.225	

NOTE 1: All values are in degrees

NOTE 2: For interpolation between vertical and horizontal angles, a linear degradation is allowed between the values listed

TABLE 2 AZIMUTH CMN GROUND EQUIPMENT TOLERANCES

Beamwidth (Degrees)	Elevation Angle (Degrees)	Azimuth Angle (Degrees)		
		-3 to +3	±40	±60
1	0 - 15	±0.010	±0.030	±0.050
2	0 - 15	±0.020	±0.050	
3	0 - 15	±0.030	±0.060	

NOTE 1: All values are in degrees.

NOTE 2: For interpolation between vertical and horizontal angles, a linear degradation is allowed between the values listed.

NOTE 3: 1 degree beamwidth antennas must meet these requirements in both High Rate and Low Rate modes. 2 and 3 degree beamwidth antennas are required to meet these requirements in the High Rate mode only.

TABLE 2 AZIMUTH CMN GROUND EQUIPMENT TOLERANCES

Beamwidth (Degrees)	Elevation Angle (Degrees)	Azimuth Angle (Degrees)		
		-3 to +3	±40	±60
1	0 - 15	±0.010	±0.030	±0.050
2	0 - 15	±0.020	±0.050	
3	0 - 15	±0.030	±0.060	

NOTE 1: All values are in degrees.

NOTE 2: For interpolation between vertical and horizontal angles, a linear degradation is allowed between the values listed.

NOTE 3: 1 degree beamwidth antennas must meet these requirements in both High Rate and Low Rate modes. 2 and 3 degree beamwidth antennas are required to meet these requirements in the High Rate mode only.

TABLE 3 MLS FUNCTION FORMAT FOR HIGH RATE AZIMUTH

FUNCTION	Function Duration (mS)	Cumulative Time(mS)
SEQUENCE #1		
EL	5.6	0
HAZ	11.9	5.6
BD	3.1	17.5
BD	3.1	20.6
BD	3.1	23.7
BD *	3.1	26.8
HAZ	11.9	29.9
EL	5.6	41.8
HAZ	11.9	47.4
EL	5.6	59.3
SPARE	1	64.9
SEQUENCE #2		
EL	5.6	65.9
HAZ	11.9	71.5
BD2	3.1	83.4
BAZ	11.9	86.5
HAZ	11.9	98.4
EL	5.6	110.3
HAZ	11.9	115.9
EL	5.6	127.8
AUX	5.9	133.4
AUX *	5.9	139.3
SPARE	1.2	145.2
SEQUENCE #1		
EL	5.6	146.4
HAZ	11.9	152
BD	3.1	163.9
BD	3.1	167
BD	3.1	170.1
BD	3.1	173.2
HAZ	11.9	176.3
EL	5.6	188.2
HAZ	11.9	193.8

TABLE 3 MLS FUNCTION FORMAT FOR HIGH RATE AZIMUTH

FUNCTION	Function Duration (mS)	Cumulative Time(mS)
SEQUENCE #1		
EL	5.6	0
HAZ	11.9	5.6
BD	3.1	17.5
BD	3.1	20.6
BD	3.1	23.7
BD *	3.1	26.8
HAZ	11.9	29.9
EL	5.6	41.8
HAZ	11.9	47.4
EL	5.6	59.3
SPARE	1	64.9
SEQUENCE #2		
EL	5.6	65.9
HAZ	11.9	71.5
BD2	3.1	83.4
BAZ	11.9	86.5
HAZ	11.9	98.4
EL	5.6	110.3
HAZ	11.9	115.9
EL	5.6	127.8
AUX	5.9	133.4
AUX *	5.9	139.3
SPARE	1.2	145.2
SEQUENCE #1		
EL	5.6	146.4
HAZ	11.9	152
BD	3.1	163.9
BD	3.1	167
BD	3.1	170.1
BD	3.1	173.2
HAZ	11.9	176.3
EL	5.6	188.2
HAZ	11.9	193.8

TABLE 3 (Continued)

EL	5.6	429.4
HAZ	11.9	435
EL	5.6	446.9
AUX	5.9	452.2
SPARE	0.1	458.1
SEQUENCE #1		
EL	5.6	458.2
HAZ	11.9	463.8
BD	3.1	475.7
BD	3.1	478.8
BD	3.1	481.9
BD	3.1	485
HAZ	11.9	488.1
EL	5.6	500
HAZ	11.9	505.6
EL	5.6	517.5
SEQUENCE #2		
EL	5.6	523.1
HAZ	11.9	528.7
BD2	3.1	540.6
BAZ	11.9	543.7
HAZ	11.9	555.6
EL	5.6	567.5
HAZ	11.9	573.1
EL	5.6	585
AUX	5.9	590.6
AUX	5.9	596.5
AUX	5.9	602.4
AUX	5.9	608.3
SPARE	0.8	614.2
CYCLE COMPLETE		615

TABLE 3 (Continued)

- NOTE 1: When back azimuth is provided;
(a) The total number of basic data word slots available for radiation from approach azimuth = 19/cycle (30.9 Hz). (b) The total number of auxiliary data word slots available for radiation from approach azimuth = 12/cycle (19.5 Hz). (c) One basic data word and one auxiliary data word slot are available for radiation from back azimuth = 1/cycle (1.6 Hz).
- NOTE 2: Abbreviations
- | | |
|------|--|
| AUX | Any Auxiliary Data Word |
| AUX* | Any Auxiliary Data Word (radiated from Back Azimuth) |
| AZ | Approach Azimuth |
| BAZ | Back Azimuth |
| BD | Any Basic Data Word |
| BD* | Any Basic Data Word (radiated from Back Azimuth) |
| BD2 | Basic Data Word 2 |
| EL | Elevation |
| FL | Flare |
| HAZ | High Rate Azimuth |

TABLE 3 (Continued)

- NOTE 1: When back azimuth is provided;
(a) The total number of basic data word slots available for radiation from approach azimuth = 19/cycle (30.9 Hz). (b) The total number of auxiliary data word slots available for radiation from approach azimuth = 12/cycle (19.5 Hz). (c) One basic data word and one auxiliary data word slot are available for radiation from back azimuth = 1/cycle (1.6 Hz).
- NOTE 2: Abbreviations
- | | |
|------|--|
| AUX | Any Auxiliary Data Word |
| AUX* | Any Auxiliary Data Word (radiated from Back Azimuth) |
| AZ | Approach Azimuth |
| BAZ | Back Azimuth |
| BD | Any Basic Data Word |
| BD* | Any Basic Data Word (radiated from Back Azimuth) |
| BD2 | Basic Data Word 2 |
| EL | Elevation |
| FL | Flare |
| HAZ | High Rate Azimuth |

TABLE 4 (Continued)

SEQUENCE #1		
EL	5.6	147.5
FL	5.3	153.1
AZ	15.9	158.4
FL	5.3	174.3
EL	5.6	179.6
BD2	3.1	185.2
BAZ	11.9	188.3
BD	3.1	200.2
EL	5.6	203.3
FL	5.3	208.9
AUX	5.9	214.2
AUX	5.9	220.1
AUX	5.9	226
SPARE	1.3	231.9
SEQUENCE #2		
EL	5.6	233.2
FL	5.3	238.8
AZ	15.9	244.1
FL	5.3	260
EL	5.6	265.3
BD	3.1	270.9
BD	3.1	274
GROWTH	12	277.1
EL	5.6	289.1
FL	5.3	294.7
SPARE	2	300
SEQUENCE #1		
EL	5.6	302
FL	5.3	307.6
AZ	15.9	312.9
FL	5.3	328.8
EL	5.6	334.1
BD2	3.1	339.7
BAZ	11.9	342.8
BD	3.1	354.7
EL	5.6	357.8

TABLE 4 (Continued)

SEQUENCE #1		
EL	5.6	147.5
FL	5.3	153.1
AZ	15.9	158.4
FL	5.3	174.3
EL	5.6	179.6
BD2	3.1	185.2
BAZ	11.9	188.3
BD	3.1	200.2
EL	5.6	203.3
FL	5.3	208.9
AUX	5.9	214.2
AUX	5.9	220.1
AUX	5.9	226
SPARE	1.3	231.9
SEQUENCE #2		
EL	5.6	233.2
FL	5.3	238.8
AZ	15.9	244.1
FL	5.3	260
EL	5.6	265.3
BD	3.1	270.9
BD	3.1	274
GROWTH	12	277.1
EL	5.6	289.1
FL	5.3	294.7
SPARE	2	300
SEQUENCE #1		
EL	5.6	302
FL	5.3	307.6
AZ	15.9	312.9
FL	5.3	328.8
EL	5.6	334.1
BD2	3.1	339.7
BAZ	11.9	342.8
BD	3.1	354.7
EL	5.6	357.8

TABLE 4 (Continued)

BD	3.1	569
GROWTH	12	572.1
EL	5.6	584.6
FL	5.3	589.7
AUX	5.9	595
AUX	5.9	600.9
AUX	5.9	606.8
SPARE	2.3	612.7
CYCLE COMPLETE		615

NOTE 1: When back azimuth is provided;

(a) The total number of basic data word slots available for radiation from approach azimuth = 15/cycle (24.4 Hz).

(b) The total number of auxiliary data word slots available for radiation from approach azimuth = 11/cycle (17.9 Hz).

(c) One basic data word and one auxiliary data word slot are available for radiation from back azimuth = 1/cycle (1.6 Hz).

NOTE 2: Abbreviations

AUX	Any Auxiliary Data Word
AUX*	Any Auxiliary Data Word (radiated from Back
Azimuth)	
AZ	Approach Azimuth
BAZ	Back Azimuth
BD	Any Basic Data Word
BD*	Any Basic Data Word (radiated from Back Azimuth)
BD2	Basic Data Word 2
EL	Elevation
FL	Flare
HAZ	High Rate Azimuth

3.2.1.1.4 Not Used.

3.2.1.1.5 Angle guidance signal requirements. Angle guidance signals transmitted by the azimuth equipment shall conform to FAA-STD-022 paragraphs 3.2.1.1, 3.2.1.2.1, 3.2.1.3.1 and 3.2.1.3.2.1 through 3.2.1.3.2.4, 3.2.3 and 4.1.3.

3.2.1.1.6 Transmitter requirements.

3.2.1.1.6.1 Channel selection.

- (1) The transmitter shall be capable of "channel selection to" and "transmitting on" each of the two hundred (200) channels assigned for MLS, (as specified in FAA-STD-022, paragraph 3.1.1 and Table 12).
- (2) Channel selection shall be accomplished by devices and controls accessible in accordance with FAA-G-2100, paragraph 3.3.3.4.
- (3) The transmitter shall have the capability to select any channel without changing components or rewiring the system.

3.2.1.1.6.2 Minimum output power. Each equipment shall provide the power densities as specified in FAA-STD-022, paragraph 3.4.1 and Table 4, and effective radiated powers as specified in Table 5.

3.2.1.1.6.3 Output power adjustment. The transmitter output power shall be adjustable from the maximum to below the monitor limits.

3.2.1.1.6.4 Radio frequency signal spectrum. All radiated signals shall comply with FAA-STD-022, paragraph 4.1.4.1.

3.2.1.1.6.5 Modulation. All radiated signals shall be modulated in accordance with FAA-STD-022, paragraph 4.1.5.

3.2.1.1.6.6 Frequency tolerance. The transmitter frequency shall comply with the requirements of FAA-STD-022, paragraph 4.1.4.3

3.2.1.1.6.7 Residual radiation. The transmitting equipment shall comply with the requirements of FAA-STD-022, paragraph 4.1.4.4.

3.2.1.1.4 Not Used.

3.2.1.1.5 Angle guidance signal requirements. Angle guidance signals transmitted by the azimuth equipment shall conform to FAA-STD-022 paragraphs 3.2.1.1, 3.2.1.2.1, 3.2.1.3.1 and 3.2.1.3.2.1 through 3.2.1.3.2.4, 3.2.3 and 4.1.3.

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3.2.1.1.6.1 Channel selection.

- (1) The transmitter shall be capable of "channel selection to" and "transmitting on" each of the two hundred (200) channels assigned for MLS, (as specified in FAA-STD-022, paragraph 3.1.1 and Table 12).
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3.2.1.1.6.3 Output power adjustment. The transmitter output power shall be adjustable from the maximum to below the monitor limits.

3.2.1.1.6.4 Radio frequency signal spectrum. All radiated signals shall comply with FAA-STD-022, paragraph 4.1.4.1.

3.2.1.1.6.5 Modulation. All radiated signals shall be modulated in accordance with FAA-STD-022, paragraph 4.1.5.

3.2.1.1.6.6 Frequency tolerance. The transmitter frequency shall comply with the requirements of FAA-STD-022, paragraph 4.1.4.3

3.2.1.1.6.7 Residual radiation. The transmitting equipment shall comply with the requirements of FAA-STD-022, paragraph 4.1.4.4.

3.2.1.1.7 Field monitor. The field monitor will be designed with the following characteristics:

- (1) The distance required between the transmitting and field monitor antennas shall be minimized.
- (2) The field monitor antenna shall be capable of being located anywhere within the lateral coverage of each transmitting antenna.
- (3) The field monitor antennas shall minimize the effects of multipath (vertical and lateral) on the signal received at the field monitor.
- (4) Blockage of the radiated signals by the field monitor antenna shall be minimized.
- (5) A connection, which provides the RF signal for evaluation by the Portable MLS Receiver (PMR) as specified in 3.5.1.2.2.2(7), shall be provided at the base of the field monitor antenna mast.
- (6) The field monitor shall include a tilt mechanism to allow access to the antenna and obstruction light from ground level.
- (7) The field monitor shall meet the requirements for Low Impact Resistance Structures in 3.3.6.4.
- (8) The use of the field monitor in any error correcting mechanisms to compensate for antenna stability shall be prohibited.

3.2.1.1.8 Not Used.

3.2.1.1.9 Equipment Stabilization.

- (1) After a 2 hour period of offline equipment (Appendix A) operation, the equipment shall operate within tolerance limits specified in 3.2.1.1.1, 3.2.1.1.3.2, 3.2.1.1.6.2 and 3.2.1.1.6.6 within 25 seconds of equipment selection for normal mode equipment operation.
- (2) After a 2 hour period of total equipment non-operation, with no power applied, the equipment shall operate within tolerance limits specified in 3.2.1.1.1, 3.2.1.1.3.2, 3.2.1.1.6.2 and 3.2.1.1.6.6 within 20 minutes of facility power being applied.
- (3) During the stabilization period, no hazardous guidance shall be radiated.

3.2.1.1.10 Station power. The Azimuth Station shall require no more than 40kVA of electrical power. (See Figure 2).

3.2.1.1.10.1 Site and equipment power. (See also 3.2.1.4.5.1)

- (1) The MLS equipment power supply and radome heating shall operate on a nominal 120/240 volt, 47-63 Hz, three wire, single-phase AC power source operated within the service conditions of 3.2.6.1.1.
- (2) All electrical work shall be in accordance with FAA-G-2100, paragraph 3.3.2.

3.2.1.1.10.2 Battery supply.

- (1) The selection and application of the battery supply and associated power supplies, (3.2.1.1.10.3), shall be in accordance with FAA Order 6980.26.
- (2) Each azimuth and elevation station shall operate from rechargeable batteries.
 - (a) The battery supply shall provide power to permit operation for not less than four (4) hours under the service conditions of 3.2.6.1.1, without primary power applied. Exempt from the battery power requirement are all antenna radome deicers and exhaust fans (for personnel use).
 - (b) Loss of AC power, within the limits of (a) above, shall cause no interruption of MLS Ground System operations.
- (3) Each battery supply shall be provided with an associated container.
 - (a) The container shall be fabricated from fiberglass or other suitable material which is not subject to corrosion from the battery acid or fumes.
 - (b) The container shall have a removable cover to provide access to the batteries.
 - (c) The battery container and power supply shall be protected to prevent entry of rain, snow, insects, sand and dust.
 - (d) If required, batteries shall be vented to the outside of buildings or structures to ensure equipment and personnel safety under environmental conditions defined in 3.2.6.1.1.

3.2.1.1.10.1 Site and equipment power. (See also 3.2.1.4.5.1)

- (1) The MLS equipment power supply and radome heating shall operate on a nominal 120/240 volt, 47-63 Hz, three wire, single-phase AC power source operated within the service conditions of 3.2.6.1.1.
- (2) All electrical work shall be in accordance with FAA-G-2100, paragraph 3.3.2.

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 - (a) The container shall be fabricated from fiberglass or other suitable material which is not subject to corrosion from the battery acid or fumes.
 - (b) The container shall have a removable cover to provide access to the batteries.
 - (c) The battery container and power supply shall be protected to prevent entry of rain, snow, insects, sand and dust.
 - (d) If required, batteries shall be vented to the outside of buildings or structures to ensure equipment and personnel safety under environmental conditions defined in 3.2.6.1.1.

3.2.1.1.10.3 Power supply.

- (1) The power supply shall provide sufficient power to operate the MLS equipment while simultaneously restoring the battery supply to full charge from a fifty (50) percent discharged condition within 36 hours.
- (2) The contractor shall provide an automatic battery disconnect which will protect the battery against damage due to deep discharge.
- (3) The Azimuth and Elevation Stations shall operate within applicable specification tolerances with or without the battery supply installed.
- (4) When primary power is applied, the charge state of the battery shall not affect the operation of the MLS equipment.

3.2.1.1.10.4 Voltage regulators.

- (1) External voltage regulating transformers shall not be used with this equipment.
- (2) Voltage regulation in the equipment shall be provided, (if applicable), by means of voltage or current regulators, or both, in the DC output circuits of the power supplies.

3.2.1.1.10.5 Convenience outlets.

- (1) As a minimum, two grounded, duplex, convenience outlets, equipped with a ground fault interrupter, protected by a circuit breaker, with parallel slots and double sided contacts, rated at 20 amps, 120 volts AC, shall be provided at each equipment location and each field monitor.
- (2) These outlets will be suitable as a source for test equipment and shall be in compliance with the exterior requirements of FAA-C-1217.
- (3) The convenience outlets and wiring thereto shall be in accordance with the FAA-G-2100, paragraph 3.3.2.

3.2.1.1.11 Approach Azimuth and High Rate Approach Azimuth Modes. The Azimuth equipment shall be switchable (by programming the appropriate data base parameter values in firmware) between Approach Azimuth and the High Rate Approach Azimuth modes. The Azimuth equipment will normally operate in the High Rate Approach Azimuth mode as identified in FAA-STD-022, Tables 1 and 3, except for those equipments with Type VI antennas which will normally operate in the Approach Azimuth mode as identified in FAA-STD-022, Tables 1 and 3.

3.2.1.1.10.3 Power supply.

- (1) The power supply shall provide sufficient power to operate the MLS equipment while simultaneously restoring the battery supply to full charge from a fifty (50) percent discharged condition within 36 hours.
- (2) The contractor shall provide an automatic battery disconnect which will protect the battery against damage due to deep discharge.
- (3) The Azimuth and Elevation Stations shall operate within applicable specification tolerances with or without the battery supply installed.
- (4) When primary power is applied, the charge state of the battery shall not affect the operation of the MLS equipment.

3.2.1.1.10.4 Voltage regulators.

- (1) External voltage regulating transformers shall not be used with this equipment.
- (2) Voltage regulation in the equipment shall be provided, (if applicable), by means of voltage or current regulators, or both, in the DC output circuits of the power supplies.

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- (2) These outlets will be suitable as a source for test equipment and shall be in compliance with the exterior requirements of FAA-C-1217.
- (3) The convenience outlets and wiring thereto shall be in accordance with the FAA-G-2100, paragraph 3.3.2.

3.2.1.1.11 Approach Azimuth and High Rate Approach Azimuth Modes. The Azimuth equipment shall be switchable (by programming the appropriate data base parameter values in firmware) between Approach Azimuth and the High Rate Approach Azimuth modes. The Azimuth equipment will normally operate in the High Rate Approach Azimuth mode as identified in FAA-STD-022, Tables 1 and 3, except for those equipments with Type VI antennas which will normally operate in the Approach Azimuth mode as identified in FAA-STD-022, Tables 1 and 3.

TABLE 6 ANTENNA TYPES

Equipment Type	<u>AZIMUTH</u>		<u>ELEVATION</u>	
	<u>Proportional Beamwidth (degrees)</u>	<u>Coverage (degrees)</u>	<u>Proportional Beamwidth (degrees)</u>	<u>Coverage (degrees)</u>
(a) Type I	2	±40	1.5	+0.9 to +15
(b) Type II	2	±40	1	"
(c) Type III	1	±40	1.5	"
(d) Type IV	1	±40	1	"
(e) Type VI	1	±60	1	"
(f) Type VII	3	±40	2	"

3.2.1.1.13.3 Out-of-Coverage Indication (OCI).

- (1) OCI signals in accordance with FAA-STD-022, paragraph 3.2.1.2.1.2 shall be provided with each equipment as stated in 3.2.1.1(3)(b) and where required as specified in FAA-STD-022, paragraph 4.1.6.
- (2) Each azimuth equipment shall have the provision for 6 OCI antennas.
- (3) OCI pulse pairs shall be transmitted in the OCI event time slot of each azimuth function transmission.
- (4) Two types of OCI antenna shall be available as follows:
 - (a) High Gain OCI Antenna. This OCI antenna shall exceed by at least 2 dB the reflection from a single reflector located within the coverage volume, with a -6 dB reflection coefficient and a resulting OCI coverage requirement of 20 degrees horizontal and 5 degrees vertical.
 - (b) General OCI Antenna. The OCI signal shall be at least 2 dB greater than the scanning beam peak dynamic sidelobe level. The purpose of this antenna is to cover direct and reflected sidelobe radiation. The minimum antenna coverage requirement is 140 degrees horizontal and 15 degrees vertical.

3.2.1.1.14 Azimuth antenna requirements. The equipment specified herein includes as separate types, scanning beam antennas of differing beamwidths and coverages, as specified in Table 6 and in FAA-STD-022, paragraph 4.5. All antennas are required to meet the specified characteristics over the range of MLS channels, (as specified in FAA-STD-022, Table 12).

3.2.1.1.14.1 Scanning beam antennas (Azimuth).

3.2.1.1.14.1.1 Patterns.

- (1) Antenna beam shape.
 - (a) The antenna beamshape, as measured with the beam steered to zero degrees azimuth and at a 3 degree elevation angle, shall satisfy the requirements of FAA-STD-022, paragraph 4.5.2.2.
 - (b) The antenna beamwidths shall be as specified in Table 6 for the various MLS equipment types.
 - (c) The beamwidth of the antenna, measured at the -3 dB points, shall be no more than 10 percent wider than the applicable beamwidth specified in Table 6.

3.2.1.1.13.3 Out-of-Coverage Indication (OCI).

- (1) OCI signals in accordance with FAA-STD-022, paragraph 3.2.1.2.1.2 shall be provided with each equipment as stated in 3.2.1.1(3)(b) and where required as specified in FAA-STD-022, paragraph 4.1.6.
- (2) Each azimuth equipment shall have the provision for 6 OCI antennas.
- (3) OCI pulse pairs shall be transmitted in the OCI event time slot of each azimuth function transmission.
- (4) Two types of OCI antenna shall be available as follows:
 - (a) High Gain OCI Antenna. This OCI antenna shall exceed by at least 2 dB the reflection from a single reflector located within the coverage volume, with a -6 dB reflection coefficient and a resulting OCI coverage requirement of 20 degrees horizontal and 5 degrees vertical.
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3.2.1.1.14.1 Scanning beam antennas (Azimuth).

3.2.1.1.14.1.1 Patterns.

- (1) Antenna beam shape.
 - (a) The antenna beamshape, as measured with the beam steered to zero degrees azimuth and at a 3 degree elevation angle, shall satisfy the requirements of FAA-STD-022, paragraph 4.5.2.2.
 - (b) The antenna beamwidths shall be as specified in Table 6 for the various MLS equipment types.
 - (c) The beamwidth of the antenna, measured at the -3 dB points, shall be no more than 10 percent wider than the applicable beamwidth specified in Table 6.

TABLE 7 AZIMUTH EFFECTIVE SIDELOBE TOLERANCES (CMN)

Beamwidth (degrees)	Format	Reflection Coefficient	0° Azimuth	±40° Azimuth	Reflector Locations
1	High Rate	+5 dB	±0.035°	±0.050°	±90° to within 2 beamwidth of the receiver angle
1	Low Rate	-6 dB	±0.020°	±0.030°	"
2	High Rate	-6 dB	±0.035°	±0.050	"
3	High Rate	-6 dB	±0.065°	±0.090°	"

NOTE 1: All values, unless otherwise indicated, are in degrees.

3.2.1.1.14.1.2 Alignment and tilt controls.

- (1) The support structure shall have provisions for leveling the array and for coarse alignment of the antenna boresight during installation.
- (2) Mechanical, optical, and/or electronic techniques shall be provided to achieve precise alignment of the zero degree course line.
- (3) Following precision alignment, the mean error of contiguous data samples taken at an appropriate reference point for a period of 10 seconds or longer shall not exceed ± 0.005 beamwidth.
- (4) Additionally, the azimuth antenna shall provide boresight adjustments as follows:
 - (a) Electrical/Steerable in Azimuth: $\pm 1^\circ$, 0.005° resolution;
 - (b) Mechanical: Elevation Tilt From Horizontal: $\pm 1.5^\circ$,
Resolution 0.1° or less
Azimuth & Roll: 0.5° ,
Resolution 0.1° or less

3.2.1.1.14.1.3 Antenna stability. The antennas shall be designed such that the 3-sigma value of the mean angle error as measured by the field monitor (installed at its nominal distance) does not exceed ± 10 feet at the reference datum over the range of service conditions as specified in 3.2.6.1.1.

3.2.1.1.14.1.4 Polarization. The radiated signals shall comply with FAA-STD-022, paragraph 4.1.4.2 and the accuracy requirements of 3.2.1.1.1.

3.2.1.2 Elevation equipment.

- (1) The elevation equipment shall operate and provide the elevation functions required in accordance with FAA-STD-022.
- (2) Each Elevation Equipment shall include the items listed below:
 - (a) Transmitter, power supplies, amplifier, executive monitor, beam steering unit and LCSU.
 - (b) Elevation scanning beam antenna and, as appropriate, OCI antennas (see 3.2.1.2.12), including associated cables/waveguides for all antennas.
 - (c) Walk-in enclosure and mounting structures.
 - (d) Field monitor antenna, supporting structures, electronics, and associated cables.

3.2.1.1.14.1.2 Alignment and tilt controls.

- (1) The support structure shall have provisions for leveling the array and for coarse alignment of the antenna boresight during installation.
- (2) Mechanical, optical, and/or electronic techniques shall be provided to achieve precise alignment of the zero degree course line.
- (3) Following precision alignment, the mean error of contiguous data samples taken at an appropriate reference point for a period of 10 seconds or longer shall not exceed ± 0.005 beamwidth.
- (4) Additionally, the azimuth antenna shall provide boresight adjustments as follows:
 - (a) Electrical/Steerable in Azimuth: $\pm 1^\circ$, 0.005° resolution;
 - (b) Mechanical: Elevation Tilt From Horizontal: $\pm 1.5^\circ$,
Resolution 0.1° or less
Azimuth & Roll: 0.5° ,
Resolution 0.1° or less

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 - (a) Transmitter, power supplies, amplifier, executive monitor, beam steering unit and LCSU.
 - (b) Elevation scanning beam antenna and, as appropriate, OCI antennas (see 3.2.1.2.12), including associated cables/waveguides for all antennas.
 - (c) Walk-in enclosure and mounting structures.
 - (d) Field monitor antenna, supporting structures, electronics, and associated cables.

TABLE 8 ELEVATION PFE GROUND EQUIPMENT TOLERANCES

Beamwidth (Degrees)	Elevation Angle (Degrees)		
	0.9	1.8 - 3.0	15.0
1	±0.090	±0.030	±0.090
1.5	±0.120	±0.040	±0.120
2	±0.150	±0.050	±0.150

NOTE 1: All values are in degrees.

NOTE 2: For interpolation between vertical angles, a linear degradation is allowed between the values listed.

NOTE 3: The error limits shown apply at all azimuth angles of the antenna lateral coverage.

TABLE 8 ELEVATION PFE GROUND EQUIPMENT TOLERANCES

Beamwidth (Degrees)	Elevation Angle (Degrees)		
	0.9	1.8 - 3.0	15.0
1	±0.090	±0.030	±0.090
1.5	±0.120	±0.040	±0.120
2	±0.150	±0.050	±0.150

NOTE 1: All values are in degrees.

NOTE 2: For interpolation between vertical angles, a linear degradation is allowed between the values listed.

NOTE 3: The error limits shown apply at all azimuth angles of the antenna lateral coverage.

3.2.1.2.5 Angle guidance signal requirements. Angle guidance signals transmitted by the elevation equipment shall conform to FAA-STD-022 paragraphs 3.2.1.1, 3.2.1.3.2.1, 3.2.1.3.2.2, 3.2.1.3.2.3, 3.2.1.3.2.5, 3.2.3 and 4.1.3.

3.2.1.2.6 Transmitter requirements.

3.2.1.2.6.1 Channel selection. See 3.2.1.1.6.1.

3.2.1.2.6.2 Minimum output power. See 3.2.1.1.6.2.

3.2.1.2.6.3 Output power adjustment. See 3.2.1.1.6.3.

3.2.1.2.6.4 Radio frequency signal spectrum. See 3.2.1.1.6.4.

3.2.1.2.6.5 Modulation. See 3.2.1.1.6.5.

3.2.1.2.6.6 Frequency tolerance. See 3.2.1.1.6.6

3.2.1.2.6.7 Residual radiation. See 3.2.1.1.6.7

3.2.1.2.7 Field monitor. See 3.2.1.1.7.

3.2.1.2.8 Not Used.

3.2.1.2.9 Equipment Stabilization.

- (1) After a 2 hour period of offline equipment operation, the equipment shall operate within tolerance limits specified in 3.2.1.2.1, 3.2.1.1.3.2, 3.2.1.1.6.2 and 3.2.1.1.6.6 within 25 seconds of equipment selection for normal mode equipment operation.
- (2) After a 2 hour period of total equipment non-operation, with no power applied, the equipment shall operate within tolerance limits specified in 3.2.1.2.1, 3.2.1.1.3.2, 3.2.1.1.6.2 and 3.2.1.1.6.6 within 20 minutes of facility power being applied.

3.2.1.2.10 Station power. The Elevation Station shall require no more than 17 kVA of electrical power. (See Figure 2).

3.2.1.2.10.1 Site and equipment power. See 3.2.1.1.10.1

3.2.1.2.10.2 Battery supply. See 3.2.1.1.10.2.

3.2.1.2.10.3 Power supply. See 3.2.1.1.10.3.

3.2.1.2.10.4 Voltage regulators. See 3.2.1.1.10.4.

3.2.1.2.10.5 Convenience outlets. See 3.2.1.1.10.5.

3.2.1.2.11 Coverage.

- (1) The approach elevation shall provide proportional guidance in at least the following volume of space (referenced from the antenna phase center): vertically from 0.9 degrees to 15 degrees up to a height of 6,000 m (20,000 ft.); horizontally to ± 60 degrees; longitudinally to 20 NM within ± 40 degrees of boresight and 14 NM beyond ± 40 degrees.
- (2) The effective radiated power (ERP) shall be at least equal to the values shown in Table 5.
- (3) The above requirements shall be met with the maximum number of phase shifter failures allowed by the executive monitor in the worst case locations.

3.2.1.2.11.1 Proportional Guidance Adjustability. The lower scan limit shall be adjustable from at least +2 degrees to -1.5 degrees in steps of 0.1 degree or smaller.

3.2.1.2.12 Out-of-Coverage indication (OCI).

- (1) The equipment design shall allow provision for an OCI signal in accordance with FAA-STD-022, paragraph 3.2.1.2.2.1.
- (2) OCI signals shall be provided where required to meet FAA-STD-022, paragraph 4.1.6.

3.2.1.2.13 Elevation antenna requirements. The equipment specified herein includes scanning beam antennas of differing beamwidths. The types to be furnished to the Government shall be as specified in Table 6. All antennas are required to maintain their specified characteristics over the range of MLS channels, (as specified in FAA-STD-022, Table 12).

3.2.1.2.13.1 Scanning beam antennas (Elevation).

3.2.1.2.13.1.1 Patterns.

- (1) Antenna beam shape.
 - (a) The antenna beam shape, as measured with the beam steered to a 3 degree elevation angle and at 0 degrees azimuth, shall satisfy the requirements of FAA-STD-022, paragraph 4.5.2.2.
 - (b) The antenna beamwidths shall be as specified in Table 6 for the various MLS Ground System types.
 - (c) The beamwidth of the antenna, measured at the -3 dB points, shall be no more than 10 percent wider than the applicable beamwidth specified in Table 6.

3.2.1.2.11 Coverage.

- (1) The approach elevation shall provide proportional guidance in at least the following volume of space (referenced from the antenna phase center): vertically from 0.9 degrees to 15 degrees up to a height of 6,000 m (20,000 ft.); horizontally to ± 60 degrees; longitudinally to 20 NM within ± 40 degrees of boresight and 14 NM beyond ± 40 degrees.
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- (1) Antenna beam shape.
 - (a) The antenna beam shape, as measured with the beam steered to a 3 degree elevation angle and at 0 degrees azimuth, shall satisfy the requirements of FAA-STD-022, paragraph 4.5.2.2.
 - (b) The antenna beamwidths shall be as specified in Table 6 for the various MLS Ground System types.
 - (c) The beamwidth of the antenna, measured at the -3 dB points, shall be no more than 10 percent wider than the applicable beamwidth specified in Table 6.

TABLE 10 ELEVATION EFFECTIVE SIDELobe TOLERANCES

Beamwidth	Reflection Coefficient	PFE Error	CMN Error	Elevation Angle	Reflector Locations
1°(1)	-1 dB	0.083°	0.045°	2°,3°,6°,9°	All elevation angles from -15° to 0°
1.5°(2)	-1 dB	0.083°	0.045°	"	"
2°(3)	-1 dB	0.083°	0.045°	"	"

Notes: (1) Antenna phase center heights up to 40 feet above the local terrain.
(2) Antenna phase center heights up to 30 feet above the local terrain.
(3) Antenna phase center heights up to 10 feet above the local terrain.

- (4) Additionally, the antenna boresight adjustment shall be as follows:

- (a) Electrical/Steerable in Elevation: $\pm 1^\circ$, resolution: 0.005°
- (b) Mechanical: Elevation Tilt from Horizontal: $\pm 0.5^\circ$,
resolution 0.1° or less
Roll: 0.5° , resolution 0.1° or less

3.2.1.2.13.1.3 Antenna stability. The antennas shall be designed such that the 3-sigma value of the mean angle error as measured by the field monitor (installed at its nominal distance) does not exceed ± 0.067 degree over the range of service conditions as specified in 3.2.6.1.1.

3.2.1.2.13.1.4 Polarization. The radiated signals shall comply with FAA-STD-022, paragraph 4.1.4.2 and the accuracy requirements of 3.2.1.2.1.

3.2.1.3 Data Transmission. The transmission of data information shall be performed by the Azimuth station in accordance with FAA-STD-022, paragraphs 3.2.2 and 4.1.5.2.

3.2.1.3.1 Basic Data.

3.2.1.3.1.1 Status information.

- (1) The status of the azimuth, elevation, DME/P, and Back Azimuth (when provided) equipments shall be transmitted in the Basic Data as defined in Table 6 of FAA-STD-022.
- (2) Any change of status shall be reflected as a change in the data word content within one second following the change.

3.2.1.3.2 Auxiliary Data.

- (1) Capability shall be provided to encode a total of 192 auxiliary data words in accordance with FAA-STD-022, paragraphs 3.2.2.3 and 3.7. The words may be in either digital or alphanumeric format.
- (2) Provision shall be made to radiate and monitor any select group or all of these words. The minimum transmission rates will vary between 0.1 and 1.0 Hz.
- (3) Provision shall be made to make maximum use of available time slots to transmit these words. This will include transmitting all basic and auxiliary data at their minimum allowable rates.
- (4) Provisions shall be made to update variable auxiliary data words directly from external sensors. The interface for this input will consist of an EIA-232 port at the Remote Control and Status Unit (RCSU) Electronics Unit (REU).

- (4) Additionally, the antenna boresight adjustment shall be as follows:

- (a) Electrical/Steerable in Elevation: $\pm 1^\circ$, resolution: 0.005°
- (b) Mechanical: Elevation Tilt from Horizontal: $\pm 0.5^\circ$,
resolution 0.1° or less
Roll: 0.5° , resolution 0.1° or less

3.2.1.2.13.1.3 Antenna stability. The antennas shall be designed such that the 3-sigma value of the mean angle error as measured by the field monitor (installed at its nominal distance) does not exceed ± 0.067 degree over the range of service conditions as specified in 3.2.6.1.1.

3.2.1.2.13.1.4 Polarization. The radiated signals shall comply with FAA-STD-022, paragraph 4.1.4.2 and the accuracy requirements of 3.2.1.2.1.

3.2.1.3 Data Transmission. The transmission of data information shall be performed by the Azimuth station in accordance with FAA-STD-022, paragraphs 3.2.2 and 4.1.5.2.

3.2.1.3.1 Basic Data.

3.2.1.3.1.1 Status information.

- (1) The status of the azimuth, elevation, DME/P, and Back Azimuth (when provided) equipments shall be transmitted in the Basic Data as defined in Table 6 of FAA-STD-022.
- (2) Any change of status shall be reflected as a change in the data word content within one second following the change.

3.2.1.3.2 Auxiliary Data.

- (1) Capability shall be provided to encode a total of 192 auxiliary data words in accordance with FAA-STD-022, paragraphs 3.2.2.3 and 3.7. The words may be in either digital or alphanumeric format.
- (2) Provision shall be made to radiate and monitor any select group or all of these words. The minimum transmission rates will vary between 0.1 and 1.0 Hz.
- (3) Provision shall be made to make maximum use of available time slots to transmit these words. This will include transmitting all basic and auxiliary data at their minimum allowable rates.
- (4) Provisions shall be made to update variable auxiliary data words directly from external sensors. The interface for this input will consist of an EIA-232 port at the Remote Control and Status Unit (RCSU) Electronics Unit (REU).

3.2.1.4.3.1.1 Range.

- (1) The system shall provide a means of measurement of slant range distance from an aircraft to a selected DME/P antenna to the limit of coverage prescribed by the operational requirements for the selected transponder.
- (2) Each DME/P transponder shall provide the appropriate reply to Normal Distance Measuring Equipment (DME/N) and DME/P interrogation signals as described in Appendix B.

3.2.1.4.3.1.2 Coverage.

- (1) The DME/P coverage shall be omni-directional.
- (2) Power densities shall meet the requirements given in 3.2.1.4.4.1.5.

3.2.1.4.3.1.3 Transponder accuracy.

- (1) The accuracy (reply delay time (Appendix A)) shall be as specified in 3.2.1.4.4.1.6.1.
- (2) In addition, the transponder accuracy shall be such that the system accuracies specified in FAA-STD-022, paragraph 3.5.4 are met.

3.2.1.4.3.2 Radio frequencies and polarization.

- (1) The transponder antenna shall receive and radiate vertically polarized signals in the frequency band 960 MHz to 1215 MHz.
- (2) The interrogation and reply frequencies shall be assigned in accordance with Table 12 of FAA-STD-022.

3.2.1.4.3.3 Channeling.

3.2.1.4.3.3.1 DME channels. DME channels shall be formed by pairing interrogation and reply frequencies and by pulse coding (Appendix A) on the paired frequencies.

3.2.1.4.3.3.2 Pulse coding. Each DME/P channel shall have two different interrogation pulse codes as shown in Table 11. One will be used in the initial approach (IA) mode; the other will be used in the final approach (FA) mode.

3.2.1.4.3.3.3 DME/P operating channels.

- (1) DME/P shall operate on any of the 200 channels listed in Table 12 of FAA-STD-022 in which the channel numbers, frequencies, and pulse codes are assigned and paired with MLS channel numbers.

- (2) Any channel shall be selectable without replacing or re-wiring components.

3.2.1.4.3.4 Reply efficiency.

- (1) The DME/P transponder shall meet or exceed the following reply efficiency requirements with a transponder accuracy (reply delay) as required in 3.2.1.4.4.1.6.1.
 - (a) Transponder Unloaded condition (Appendix A):
 - (i) 75% for the IA mode (see note) of a DME/P transponder, and
 - (ii) 80% for the FA mode of a DME/P transponder.
 - (b) Transponder Loaded Condition (Appendix A):
 - (i) 70% for the IA mode (see note) of a DME/P transponder, and
 - (ii) 75% for the FA mode of a DME/P transponder.

NOTE: The DME/N interrogations are serviceable through the IA mode with accuracy as specified in 3.2.1.4.4.1.6.1 and reply efficiency of 70%.

3.2.1.4.3.5 Transponder identification. All DME/P transponders shall transmit an identification signal using the International Morse Code identification (ID) signals as specified in 3.2.1.4.4.1.6.2.

3.2.1.4.3.6 Squitter pulses. (Appendix A) Each transponder shall transmit randomly distributed pulse pairs, in addition to those transmitted for ID and interrogation replies, sufficient in number to maintain a minimum transmission rate of 700 pulse pairs per second as specified in 3.2.1.4.4.1.6.3.

3.2.1.4.4 Specific transponder requirements.

3.2.1.4.4.1 Transmitted signal characteristics.

3.2.1.4.4.1.1 Radio frequency stability. The output radio frequency of the transponder shall be within 0.001 percent of that specified for the assigned channel.

- (2) Any channel shall be selectable without replacing or re-wiring components.

3.2.1.4.3.4 Reply efficiency.

- (1) The DME/P transponder shall meet or exceed the following reply efficiency requirements with a transponder accuracy (reply delay) as required in 3.2.1.4.4.1.6.1.
 - (a) Transponder Unloaded condition (Appendix A):
 - (i) 75% for the IA mode (see note) of a DME/P transponder, and
 - (ii) 80% for the FA mode of a DME/P transponder.
 - (b) Transponder Loaded Condition (Appendix A):
 - (i) 70% for the IA mode (see note) of a DME/P transponder, and
 - (ii) 75% for the FA mode of a DME/P transponder.

NOTE: The DME/N interrogations are serviceable through the IA mode with accuracy as specified in 3.2.1.4.4.1.6.1 and reply efficiency of 70%.

3.2.1.4.3.5 Transponder identification. All DME/P transponders shall transmit an identification signal using the International Morse Code identification (ID) signals as specified in 3.2.1.4.4.1.6.2.

3.2.1.4.3.6 Squitter pulses. (Appendix A) Each transponder shall transmit randomly distributed pulse pairs, in addition to those transmitted for ID and interrogation replies, sufficient in number to maintain a minimum transmission rate of 700 pulse pairs per second as specified in 3.2.1.4.4.1.6.3.

3.2.1.4.4 Specific transponder requirements.

3.2.1.4.4.1 Transmitted signal characteristics.

3.2.1.4.4.1.1 Radio frequency stability. The output radio frequency of the transponder shall be within 0.001 percent of that specified for the assigned channel.

3.2.1.4.4.1.2 Pulse shape. The RF envelope of each pulse transmitted, as detected by a linear detector, shall be as follows, (see Figure 3).

3.2.1.4.4.1.2.1 Pulse rise time.

- (1) The rise time shall be between 0.8 μ sec and 1.2 μ sec.
- (2) For replies to FA mode interrogations, the first pulse of each pair shall have a partial rise time between 0.2 μ sec and 0.3 μ sec, and the instantaneous slope in the partial rise time region shall not vary more than ± 20 percent.

3.2.1.4.4.1.2.2 Pulse width. The pulse width shall be 3.5 (± 0.5) μ sec.

3.2.1.4.4.1.2.3 Pulse decay time. The decay time shall not exceed 3.5 μ sec.

3.2.1.4.4.1.2.4 Ripple. The amplitude of the pulse shall not, at any instant between the point on the leading edge which is 95 percent of the maximum voltage amplitude and the point on the trailing edge which is 95 percent of the maximum voltage amplitude, fall below a value which is 95 percent of the maximum voltage amplitude.

3.2.1.4.4.1.2.5 Pulse Pedestal.

- (1) If there is a pulse pedestal or a pulse turn-on transient which occurs in time prior to the virtual origin (Appendix A), the amplitude shall be 0.1 percent or less relative to the pulse peak amplitude in the region between 1000 nanoseconds to 300 nanoseconds prior to the virtual origin as shown in Figure 4.
- (2) In the region between 300 nanoseconds prior to the virtual origin and the virtual origin, the leading edge of the pulse shall be bounded by the line drawn from the 0.1 percent amplitude at 300 nanoseconds to the 1.0 percent amplitude at the virtual origin.
- (3) In the region of the virtual origin, the excursions of leading edge of the pulse shall be confined to the region bounded by lines drawn from the plus and minus 20 nanosecond point on the time axis to the 5 percent amplitude point.

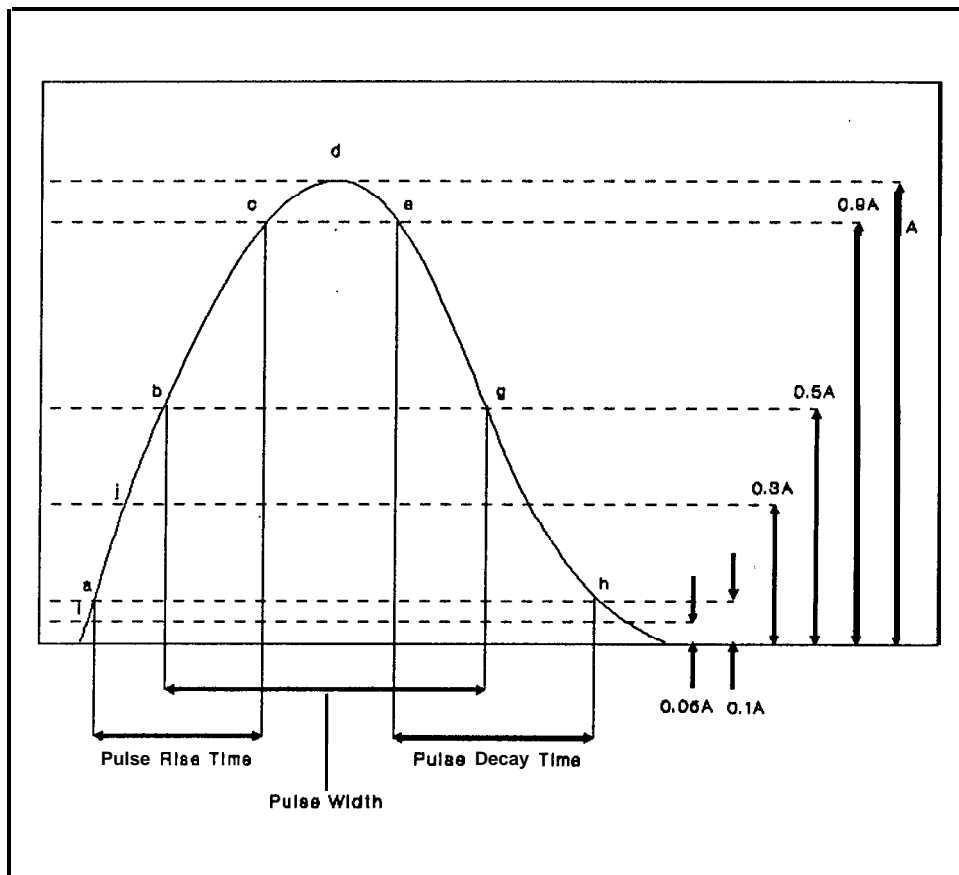


FIGURE 3 DME/P PULSE ENVELOPE

FIGURE 3 DEFINITIONS:

- (a) Leading edge of pulse at 0.1A and 0.9A is denoted by points (a) and (c) respectively. Trailing edge of pulse at 0.9A and 0.1A is denoted by points (e) and (h) respectively.
- (b) Intersections at 0.5A are denoted by points (b) and (g).
- (c) Peak of pulse (A) is denoted by point (d).
- (d) Leading edge of DME/P pulse at 0.05A and 0.3A is denoted by points (i) and (j) respectively.
- (e) Pulse amplitude (A): The peak amplitude of the pulse envelope.
- (f) Pulse width (t): The time interval between points (b) and (g).
- (g) Pulse rise time: The time interval between points (a) and (c).
- (h) Pulse decay time: The time interval between points (e) and (h).
- (i) Pulse partial rise time: The time interval between points (i) and (j).

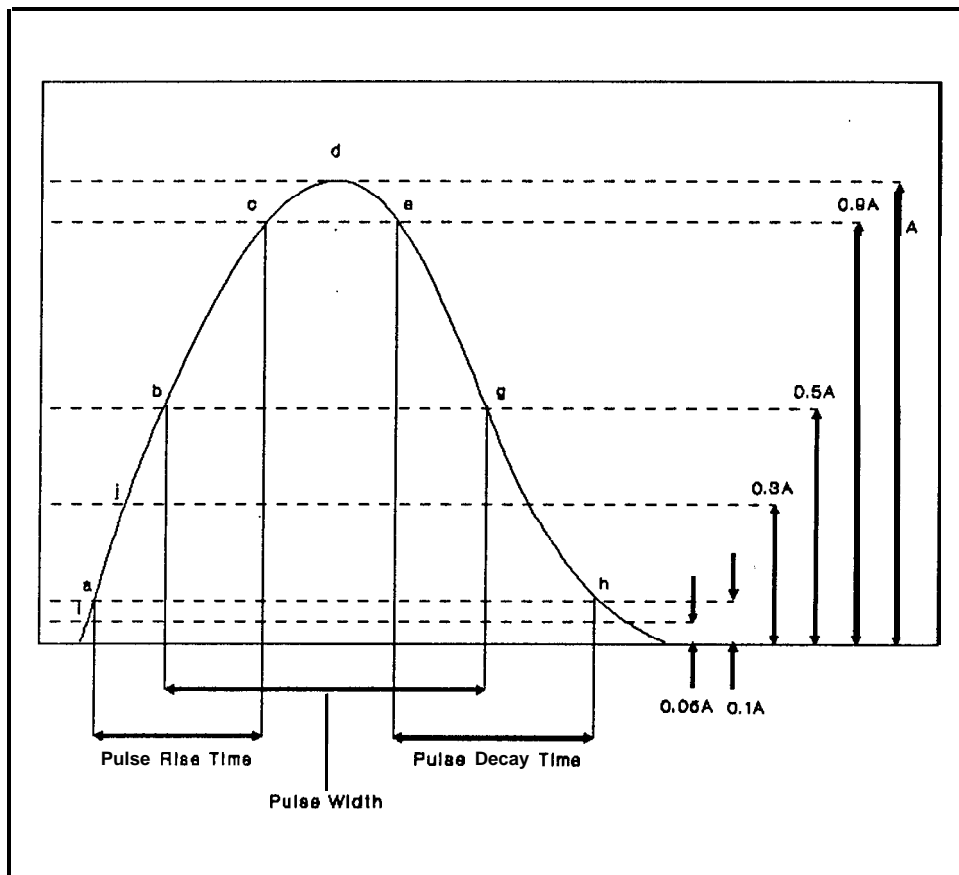


FIGURE 3 DME/P PULSE ENVELOPE

FIGURE 3 DEFINITIONS:

- (a) Leading edge of pulse at 0.1A and 0.9A is denoted by points (a) and (c) respectively. Trailing edge of pulse at 0.9A and 0.1A is denoted by points (e) and (h) respectively.
- (b) Intersections at 0.5A are denoted by points (b) and (g).
- (c) Peak of pulse (A) is denoted by point (d).
- (d) Leading edge of DME/P pulse at 0.05A and 0.3A is denoted by points (i) and (j) respectively.
- (e) Pulse amplitude (A): The peak amplitude of the pulse envelope.
- (f) Pulse width (t): The time interval between points (b) and (g).
- (g) Pulse rise time: The time interval between points (a) and (c).
- (h) Pulse decay time: The time interval between points (e) and (h).
- (i) Pulse partial rise time: The time interval between points (i) and (j).

3.2.1.4.4.1.3 RF pulse signal spectrum.

- (1) The spectrum of the pulse modulated signal shall be such that, during the pulse, the equivalent isotropically radiated power (Appendix A) contained in a 0.5 MHz band centered on frequencies 0.8 MHz above or 0.8 MHz below the nominal channel frequency shall not exceed 200 milliwatts.
- (2) The equivalent isotropically radiated power contained in a 0.5 MHz band centered on frequencies 2 MHz above or 2 MHz below the nominal channel frequency shall not exceed 2 milliwatts. The power contained in the frequency bands defined above is the energy contained in that frequency band divided by the time of pulse transmission. The "time of pulse transmission" is the interval measured between the 5 percent of maximum voltage amplitude points on the leading and trailing edges of the pulse envelope.
- (3) Any lobe of the spectrum shall be of less amplitude than the adjacent lobe nearer the nominal channel frequency.

3.2.1.4.4.1.3.1 Out-of-band spurious output. At all frequencies from 10 to 1800 MHz, but excluding the band of frequencies from 960 to 1215 MHz, the spurious output as measured at the transponder cabinet port shall not exceed -40 dBm/kHz of receiver bandwidth. For purposes of determining compliance, measurement will be made using a receiver having a -6 dB bandwidth of 100 kHz or less.

3.2.1.4.4.1.3.2 In-band spurious output.

- (1) The RF output level during the interval between occurrences of pulse pair transmissions shall be at least 80 dB below the maximum power level during the pulses.
- (2) In addition, between the pulses of each pair there shall be an interval of at least 1.0 μ sec during which the RF output level is at least 80 dB below the maximum power level of each pulse.

3.2.1.4.4.1.3.3 Harmonics. The equivalent isotropically radiated power of any continuous wave (CW) harmonic of the carrier frequency on any DME/P operating channel shall not exceed -10 dBm.

3.2.1.4.4.1.4 Polarization. The equivalent isotropically radiated signals shall be vertically polarized with a cross-polarization content of less than -15 dB.

3.2.1.4.4.1.5 Power densities.

- (1) At all azimuth angles and at elevation angles from +0.9° to at least +15° relative to the DME/P antenna phase center and up to altitudes of at least 20,000 feet, the radiated pulses shall have at least the following peak envelope power (Appendix A) densities under all operational weather conditions:
 - (a) -89 dBW/m² at ranges from 7 NM to 22 NM from the DME/P antenna.
 - (b) -75 dBW/m² at ranges from the approach reference datum to 7 NM from the DME/P antenna.
 - (c) -70 dBW/m² at the MLS approach reference datum.
 - (d) -79 dBW/m² above the runway surface from 8 feet (2.5 meters) above the MLS datum point or the farthest point on the runway centerline which is in line of sight of the DME/P antenna to at least a height of 2,000 feet.

NOTE: These power densities must be provided in an operational site environment that includes ground reflectivity, phase center height, and low angle cut-off characteristics of the DME/P antenna.

3.2.1.4.4.1.6 Signals transmitted.

- (1) Only pulse pairs shall be transmitted.
- (2) The individual pulses of any pulse pair shall not be transmitted between the pulses of any other pulse pair.
- (3) Each pulse pair transmitted shall have the pulse coding appropriate to the channel of operation.
- (4) The difference in peak power levels of the pulses of a pulse pair shall not exceed 1 dB.
- (5) Each pulse pair transmitted shall belong to one of the following categories identified in 3.2.1.4.4.1.6.1 through 3.2.1.4.4.1.6.3.

3.2.1.4.4.1.6.1 Replies to valid interrogations.

- (1) Replies to valid interrogations shall have a nominal reply delay time for the channel of operation shown in Table 11. Valid interrogations are those which conform to the requirements of Appendix B.
- (2) Deviations from the nominal reply delay time shall not exceed $\pm 0.5 \mu\text{sec}$ for DME/N interrogations.

- (3) Deviations from the nominal reply delay time shall not exceed $\pm 0.100 \mu\text{sec}$ path following error (Appendix A) (PFE) and $\pm 0.067 \mu\text{sec}$ CMN, on a 95 percentile basis for DME/P IA mode interrogations.
- (4) Deviations from the nominal reply delay time shall not exceed $\pm 0.067 \mu\text{sec}$ PFE and $\pm 0.053 \mu\text{sec}$ CMN, on a 95 percentile basis for DME/P FA mode interrogations.
- (5) The reply delay time requirement shall apply for all interrogation signals whose power density is within the limits of Appendix B, 20.6.

a. Multipath performance.

- (1) The transponder signal processing shall be such that reply delay time variations, due to multipath interference with the interrogation pulse pairs which cause any scalloping frequency between 0.05 Hz and 200 Hz, are controlled as follows for the FA Mode.
 - (a) Multipath signals that arrive within 350 nanoseconds after the direct signal and with amplitudes of 3 dB or more below the direct signal shall not change the transponder FA mode reply delay by more than ± 0.066 microseconds, (peak error for all relative phases with 95% probability).
 - (b) Multipath signals that arrive more than 350 nanoseconds after the direct signal and with amplitudes of 3 dB or more below the direct signal shall not change the transponder FA mode reply delay by more than ± 0.006 microseconds, (peak error for all relative phases with 95% probability).
- (2) The transponder signal processing shall be such that reply delay time variations, due to multipath interference with the interrogation pulse pairs which cause any scalloping frequency between 0.05 Hz and 200 Hz, are controlled as follows for the IA Mode.
 - (a) Multipath signals that arrive within 2.7 microseconds of the direct signal and with amplitudes of 6 dB or more below the direct signal shall not change the transponder IA mode reply delay by more than ± 0.25 microsecond, (peak error for all relative phases with 95% probability).
 - (b) Multipath signals that arrive more than 2.7 microseconds after the direct signal and amplitudes of 6 dB or more below the direct signal shall not change the transponder IA mode reply delay by more than ± 0.013 microseconds, (peak error for all relative phases with 95% probability).

- (3) Deviations from the nominal reply delay time shall not exceed $\pm 0.100 \mu\text{sec}$ path following error (Appendix A) (PFE) and $\pm 0.067 \mu\text{sec}$ CMN, on a 95 percentile basis for DME/P IA mode interrogations.
- (4) Deviations from the nominal reply delay time shall not exceed $\pm 0.067 \mu\text{sec}$ PFE and $\pm 0.053 \mu\text{sec}$ CMN, on a 95 percentile basis for DME/P FA mode interrogations.
- (5) The reply delay time requirement shall apply for all interrogation signals whose power density is within the limits of Appendix B, 20.6.

a. Multipath performance.

- (1) The transponder signal processing shall be such that reply delay time variations, due to multipath interference with the interrogation pulse pairs which cause any scalloping frequency between 0.05 Hz and 200 Hz, are controlled as follows for the FA Mode.
 - (a) Multipath signals that arrive within 350 nanoseconds after the direct signal and with amplitudes of 3 dB or more below the direct signal shall not change the transponder FA mode reply delay by more than ± 0.066 microseconds, (peak error for all relative phases with 95% probability).
 - (b) Multipath signals that arrive more than 350 nanoseconds after the direct signal and with amplitudes of 3 dB or more below the direct signal shall not change the transponder FA mode reply delay by more than ± 0.006 microseconds, (peak error for all relative phases with 95% probability).
- (2) The transponder signal processing shall be such that reply delay time variations, due to multipath interference with the interrogation pulse pairs which cause any scalloping frequency between 0.05 Hz and 200 Hz, are controlled as follows for the IA Mode.
 - (a) Multipath signals that arrive within 2.7 microseconds of the direct signal and with amplitudes of 6 dB or more below the direct signal shall not change the transponder IA mode reply delay by more than ± 0.25 microsecond, (peak error for all relative phases with 95% probability).
 - (b) Multipath signals that arrive more than 2.7 microseconds after the direct signal and amplitudes of 6 dB or more below the direct signal shall not change the transponder IA mode reply delay by more than ± 0.013 microseconds, (peak error for all relative phases with 95% probability).

- (i) In the event of the loss of the localizer synchronization, the DME/P shall continue to transmit its identification according to the particular sequence it is in.
- (ii) If the localizer synchronization returns, the DME/P shall delay its resynchronization to the localizer by one sequence to enable completion of the current identification code group and avoid overlap in the morse code reception.

NOTE: A sequence is equal in time to one ID code group transmission period.

3.2.1.4.4.1.6.3 Squitter outputs.

- (1) Squitter pulse pairs shall be automatically generated and controlled in order to maintain a minimum transponder output transmission rate.
- (2) The minimum output transmission rate, (replies and squitter), shall be adjustable from not less than 700 pulse pairs per second to not more than 1200 pulse pairs per second.
- (3) The transponder receiver internal noise shall not be used as the source for squitter pulses.
- (4) The distribution of these squitter pulse pairs shall be non-uniform with no pulse pairs spaced less than 200 μ sec apart or within the range of 730 to 750 μ sec.
- (5) No squitter shall be added when the output transmission rate is greater than the pre-set rate between 700 and 1200 pulse pairs per second.

3.2.1.4.4.1.7 Priority of transmission.

- (1) The transmission of transponder output signals shall have the following order of precedence: 1) distance reply pulse pairs (DME/P FA mode); 2) identification pulse pairs; 3) distance reply pulse pairs (DME/P IA mode); 4) squitter pulse pairs.
- (2) Transmission priority, employing priority intervals, shall be established on the basis of the first pulse of a pulse pair.
- (3) A priority interval, which does not exceed 12 microseconds, shall exist prior to and subsequent to the virtual origin of the first pulse.

- (4) Should the virtual origin of the first pulse of each transmissible pulse pair fall within another pulse's priority interval, then the order of priority, as listed, shall govern which pulse pair is to be transmitted.
- (5) Should the virtual origin fall outside of the priority intervals of either pulse, then priority becomes void and transmission shall be effected for the virtual origin occurring first, provided its transmission is consistent with other specification constraints.
- (6) The identification pulse pairs shall be inhibited, except during the Morse code key down periods.
 - (a) During these key down periods, no pulse pairs of lesser precedence shall be transmitted.
- (7) The IA mode distance reply pulse pairs shall not be inhibited during the time intervals between the Morse Code key-down periods, unless coincidence with an FA mode priority interval would occur.
- (8) Squitter pulse pairs shall be inhibited when the spacing between the squitter pulse pair and a reply pulse pair is such that the first pulse of the reply would be distorted (such as pulse overlap).

3.2.1.4.4.2 Interrogation signal reception and processing requirements.

The transponder shall provide the required reply delay and reply efficiency performance in response to interrogations from DME/N and DME/P airborne equipment. The characteristics of those interrogation signals are described in Appendix B.

3.2.1.4.4.2.1 Transponder threshold sensitivity.

- (1) The transponder threshold sensitivity (Appendix A) value for a single reference interrogator operating in either the IA or FA mode shall not be higher than the value necessary to provide the required performance under the following conditions:
 - (a) Signals which have the minimum power densities, specified in Appendix B, prior to the transponder antenna intercepts;
 - (b) Offset of the transponder antenna up to 450 feet from the DME/P enclosure.
- (2) Under these conditions, the transponder internal noise shall not cause more than 10 reply transmissions per second.

3.2.1.4.4.2.1.1 Signal level variations.

- (1) In the absence of other interrogation and with the transponder transmission rate of 700 pulse pairs per second, the reply efficiency shall be at least 90 percent for a single reference interrogator whose interrogation signal levels range from 10 dB above the unloaded transponder threshold sensitivity to the maximum signal level specified in Appendix B.
- (2) The transponder internal noise shall not cause more than 10 reply transmissions per second.
- (3) The requirements of 3.2.1.4.4.1.6.1 shall be satisfied in each mode of transponder operation.

3.2.1.4.4.2.1.2 Sensitivity variation with pulse coding.

- (1) Under conditions wherein the spacing of the pulses of an interrogation vary from the nominal pulse code by $\pm 1.0 \mu\text{sec}$, the threshold sensitivity value, in the absence of other interrogations, shall not increase by more than 1 dB.
- (2) Interrogations, with the spacing of the pulses deviating from the nominal pulse code by $\pm 2.0 \mu\text{sec}$ or more and with any signal level up to a signal level equivalent to the power density level of -22 dBW/m^2 , shall be rejected such that the allowed transponder transmission rate due to receiver noise is not exceeded, (3.2.1.4.4.2.1(2)).

3.2.1.4.4.2.1.3 Sensitivity variation with frequency. The threshold sensitivity value, in the absence of other interrogations, shall not increase more than 1 dB when the interrogation signal frequency deviates from the nominal value up to 112 KHz in either direction.

3.2.1.4.4.2.1.4 Sensitivity variation with interrogation loading.

- (1) While under a transponder loaded condition, the threshold sensitivity (Appendix A) value for a single reference interrogator operating in either the IA or FA mode shall be within 1 dB of that signal level required in 3.2.1.4.4.2.1(1).
- (2) These sensitivity values shall be measured for each of the following three load conditions:
 - (a) The number of IA only interrogations have any value up to 4000 pulse pairs per second,
 - (b) The number of FA only interrogations have any value up to 3000 pulse pairs per second, and

3.2.1.4.4.2.1.1 Signal level variations.

- (1) In the absence of other interrogation and with the transponder transmission rate of 700 pulse pairs per second, the reply efficiency shall be at least 90 percent for a single reference interrogator whose interrogation signal levels range from 10 dB above the unloaded transponder threshold sensitivity to the maximum signal level specified in Appendix B.
- (2) The transponder internal noise shall not cause more than 10 reply transmissions per second.
- (3) The requirements of 3.2.1.4.4.1.6.1 shall be satisfied in each mode of transponder operation.

3.2.1.4.4.2.1.2 Sensitivity variation with pulse coding.

- (1) Under conditions wherein the spacing of the pulses of an interrogation vary from the nominal pulse code by $\pm 1.0 \mu\text{sec}$, the threshold sensitivity value, in the absence of other interrogations, shall not increase by more than 1 dB.
- (2) Interrogations, with the spacing of the pulses deviating from the nominal pulse code by $\pm 2.0 \mu\text{sec}$ or more and with any signal level up to a signal level equivalent to the power density level of -22 dBW/m^2 , shall be rejected such that the allowed transponder transmission rate due to receiver noise is not exceeded, (3.2.1.4.4.2.1(2)).

3.2.1.4.4.2.1.3 Sensitivity variation with frequency. The threshold sensitivity value, in the absence of other interrogations, shall not increase more than 1 dB when the interrogation signal frequency deviates from the nominal value up to 112 KHz in either direction.

3.2.1.4.4.2.1.4 Sensitivity variation with interrogation loading.

- (1) While under a transponder loaded condition, the threshold sensitivity (Appendix A) value for a single reference interrogator operating in either the IA or FA mode shall be within 1 dB of that signal level required in 3.2.1.4.4.2.1(1).
- (2) These sensitivity values shall be measured for each of the following three load conditions:
 - (a) The number of IA only interrogations have any value up to 4000 pulse pairs per second,
 - (b) The number of FA only interrogations have any value up to 3000 pulse pairs per second, and

- (2) The time of occurrence of the single interfering pulse shall be measured between the 50 percent voltage point on the leading edge of the undesired pulse and the corresponding point on the leading edge of the first pulse of the interrogation pulse pair.
- (3) The single interfering pulse shall have all amplitudes up to 60 dB above the "N" Mode threshold signal level specified in Appendix B, 20.6.
- (4) The time of occurrence of the single interfering pulse shall be as follows: 1) DME/N type: 10 μ sec; 2) DME/P type: 8 μ sec.

3.2.1.4.4.2.2 Reply efficiency variations.

3.2.1.4.4.2.2.1 Random single pulses. With an input of 22,000 random single pulses per second distributed as follows: (1) 2000 on-frequency pulses per second with a 3 dB pulse width of 8 μ sec; (2) 20,000 pulses equally distributed between the on-channel frequency and the higher and lower, first and second adjacent channel frequencies with a DME/P pulse shape specified in Appendix B, 20.3, the transponder reply efficiency to signals from a single interrogator shall differ from that obtained without the random signal input by:

- (1) Not more than 5 percent in the FA mode when the peak amplitude of the random pulse is 10 dB less than the FA mode threshold sensitivity value;
- (2) Not more than 5 percent in the IA mode when the peak amplitude of the random pulse is 10 dB less than the IA mode threshold sensitivity value.

3.2.1.4.4.2.2.2 Continuous Wave (CW) interference.

- (1) The presence of a CW interference signal within the receiver pass-band and with a carrier power of -100 dBm at the receiver input shall not preclude compliance with the PFE performance requirements of 3.2.1.4.4.1.6.1, nor cause the reply efficiency of FA mode or IA mode interrogations from a single interrogator to change by more than 10 percent from the reply efficiency value obtained without the CW interference.
- (2) The signal level of the interrogations shall be:
 - (a) In its FA Mode of operation - set at the unloaded FA Mode transponder threshold sensitivity value, and
 - (b) In its IA Mode of operation - set at the unloaded IA Mode transponder threshold sensitivity value.

3.2.1.4.4.2.3 Input signal blanking.

- (1) The transponder shall not reply to its own transmissions. To ensure sufficient isolation between transponder output and input, the transponder receiver signal may be blanked during the transmission of each pulse of a reply pair.
 - (a) These blanking intervals shall not exceed 13 μ sec.
 - (b) The transponder threshold sensitivity value for IA or FA mode interrogations which occur within 1 μ seconds after each blanking interval shall not be increased by more than 1 dB.

3.2.1.4.4.2.4 Decoding dead time.

- (1) Each valid interrogation decoded shall initiate a dead time interval during which subsequent interrogations decoded with valid pulse codes will not be accepted for further reply processing and transmission.
 - (a) This dead time interval shall be adjustable from 0 to 80 μ sec.
 - (b) This dead time interval shall be generated and applied separately and independently to the IA or FA mode interrogation pulse codes.

3.2.1.4.4.2.5 Echo suppression.

- (1) An echo suppression feature shall be provided for the IA operating mode which in no way affects the operation of the FA mode.
- (2) The echo suppression feature is to be enabled for a selectable time interval when a valid IA mode interrogation pulse pair is received which has both pulse amplitudes in excess of a pre-set level. The preset enabling level shall be selectable in steps of 1 db from 10 dB above IA mode threshold sensitivity to in excess of the maximum interrogation signal levels specified in Appendix B, 20.6.
- (3) During the echo suppression time interval, only IA mode pulse pairs with both pulse amplitudes in excess of the enabling pulse pair will be recognized as valid IA mode interrogations. The signal level required for IA mode pulse pairs to be recognized as valid during the echo suppression interval shall be selectable in steps of 1 dB, over the range from 0 to 6 dB above the preset enabling level.

3.2.1.4.4.2.3 Input signal blanking.

- (1) The transponder shall not reply to its own transmissions. To ensure sufficient isolation between transponder output and input, the transponder receiver signal may be blanked during the transmission of each pulse of a reply pair.
 - (a) These blanking intervals shall not exceed 13 μ sec.
 - (b) The transponder threshold sensitivity value for IA or FA mode interrogations which occur within 1 μ seconds after each blanking interval shall not be increased by more than 1 dB.

3.2.1.4.4.2.4 Decoding dead time.

- (1) Each valid interrogation decoded shall initiate a dead time interval during which subsequent interrogations decoded with valid pulse codes will not be accepted for further reply processing and transmission.
 - (a) This dead time interval shall be adjustable from 0 to 80 μ sec.
 - (b) This dead time interval shall be generated and applied separately and independently to the IA or FA mode interrogation pulse codes.

3.2.1.4.4.2.5 Echo suppression.

- (1) An echo suppression feature shall be provided for the IA operating mode which in no way affects the operation of the FA mode.
- (2) The echo suppression feature is to be enabled for a selectable time interval when a valid IA mode interrogation pulse pair is received which has both pulse amplitudes in excess of a pre-set level. The preset enabling level shall be selectable in steps of 1 db from 10 dB above IA mode threshold sensitivity to in excess of the maximum interrogation signal levels specified in Appendix B, 20.6.
- (3) During the echo suppression time interval, only IA mode pulse pairs with both pulse amplitudes in excess of the enabling pulse pair will be recognized as valid IA mode interrogations. The signal level required for IA mode pulse pairs to be recognized as valid during the echo suppression interval shall be selectable in steps of 1 dB, over the range from 0 to 6 dB above the preset enabling level.

- (2) The obstruction light, the antenna and mounting structure design shall provide for maintenance by a technician at ground level or on a stable platform.

NOTE: The site sensitive phase center height of the antenna, as a function of runway length and coverage requirements, may also be a mounting structure design consideration.

3.2.1.4.5 Station power. (See Figure 2).

3.2.1.4.5.1 Site and equipment power. See 3.2.1.1.10.1

3.2.1.4.5.2 Battery supply.

- (1) The DME/P shall operate on either the Azimuth Station batteries or dedicated DME/P equipment batteries.
- (2) If dedicated DME/P equipment batteries are provided, the batteries shall meet the requirements of 3.2.1.1.10.2.

3.2.1.4.5.3 Power supply. The DME/P shall operate on the Azimuth Station power supply.

3.2.1.4.5.4 Voltage regulators. See 3.2.1.1.10.4.

3.2.1.4.5.5 Convenience outlets. Outlets shall be supplied as required by 3.2.1.1.10.5.

3.2.1.5 Remote control, status and monitoring requirements.

3.2.1.5.1 Remote Control and Status Unit.

- (1) The Remote Control and Status Unit (RCSU) shall consist of two units: a Remote Control and Status Unit Electronics Unit (REU) and a RCSU Panel.
- (2) The RCSU shall be capable of controlling and providing status information on the Azimuth (Approach and Back), Elevation (Online and Offline) and DME/P (Online and Offline) equipments.

3.2.1.5.1.1 RCSU Electronics Unit.

3.2.1.5.1.1.1 Interface requirements. The REU shall interface with the Azimuth and Elevation stations in accordance with 3.2.2.1, with the RCSU Panel and Remote Status Units (RSUs) in accordance with 3.2.2.2, with the Maintenance Processing System (MPS) in accordance with 3.2.3.1, with Auxiliary Data Word Sources in accordance with 3.2.3.2, and with Portable Maintenance Data Terminals (PMDTs) (Appendix A) in accordance with 3.2.3.3.2.

3.2.1.5.1.1.2 Physical requirements.

- (1) The REU shall provide visual front panel indications of the system status, including Normal Operation, Maintenance Warnings (Appendix A), Secondary Alerts (Appendix A) and Integrity Alarms.
- (2) Three EIA-232 connectors shall be provided and are the physical interfaces for the MPS, Auxiliary Data Word updating, and PMDT in accordance with 3.2.3.
- (3) Four fiber optic SMA connectors shall be provided and shall be the physical interfaces for two EIA-533 communication links between the Master and the Slave REUs as defined in 3.2.2.1.2.1.
 - (a) The EIA-533 links shall conform to the requirements of 3.2.2.1.2.2.
- (4) The REU shall be designed to mount in a standard 19 inch rack in accordance with FAA-G-2100, paragraph 3.3.3.2.2.
- (5) The REU shall be limited in width such that four units may be mounted side by side in one panel.
- (6) The maximum height shall be 14.0 inches and maximum depth 20 inches.
- (7) The REU shall require no more than 0.90 KVA of electrical power.
- (8) The REU shall operate on a nominal 120/240 volt, 47 - 63 Hz, single-phase AC power source.

3.2.1.5.1.2 RCSU Panel.

3.2.1.5.1.2.1 Control and display features. The following are the minimum set of features which will be provided.

- (1) The RCSU Panel shall provide visual indicators for the MLS Ground System including Normal (Green), Secondary Alerts (Appendix A) (Yellow), and Integrity Alarms (Appendix A) (Red).
- (2) The RCSU Panel shall provide separate status indications for each MLS equipment including OFF, Normal, Secondary Alert, Integrity Alarm and Control Status (Operational or Maintenance).
 - (a) All visual indications, except for Control Status, from an equipment that is under maintenance control shall not be displayed at the RCSU panel.
- (3) The RCSU Panel shall provide aural indications for Secondary Alerts and Integrity Alarms.

3.2.1.5.1.1.2 Physical requirements.

- (1) The REU shall provide visual front panel indications of the system status, including Normal Operation, Maintenance Warnings (Appendix A), Secondary Alerts (Appendix A) and Integrity Alarms.
- (2) Three EIA-232 connectors shall be provided and are the physical interfaces for the MPS, Auxiliary Data Word updating, and PMDT in accordance with 3.2.3.
- (3) Four fiber optic SMA connectors shall be provided and shall be the physical interfaces for two EIA-533 communication links between the Master and the Slave REUs as defined in 3.2.2.1.2.1.
 - (a) The EIA-533 links shall conform to the requirements of 3.2.2.1.2.2.
- (4) The REU shall be designed to mount in a standard 19 inch rack in accordance with FAA-G-2100, paragraph 3.3.3.2.2.
- (5) The REU shall be limited in width such that four units may be mounted side by side in one panel.
- (6) The maximum height shall be 14.0 inches and maximum depth 20 inches.
- (7) The REU shall require no more than 0.90 KVA of electrical power.
- (8) The REU shall operate on a nominal 120/240 volt, 47 - 63 Hz, single-phase AC power source.

3.2.1.5.1.2 RCSU Panel.

3.2.1.5.1.2.1 Control and display features. The following are the minimum set of features which will be provided.

- (1) The RCSU Panel shall provide visual indicators for the MLS Ground System including Normal (Green), Secondary Alerts (Appendix A) (Yellow), and Integrity Alarms (Appendix A) (Red).
- (2) The RCSU Panel shall provide separate status indications for each MLS equipment including OFF, Normal, Secondary Alert, Integrity Alarm and Control Status (Operational or Maintenance).
 - (a) All visual indications, except for Control Status, from an equipment that is under maintenance control shall not be displayed at the RCSU panel.
- (3) The RCSU Panel shall provide aural indications for Secondary Alerts and Integrity Alarms.

- (12) The RCSU Panel shall provide a Deny/Grant mechanism for responding to Control Mastership requests, as defined in 3.2.1.6.3.4.
- (13) The RCSU Panel shall provide a mechanism to lock out access to maintenance control for all equipments.
 - (a) The maintenance lock out mechanism shall only be effective when Control Mastership resides at the RCSU.
- (14) The RCSU Panel shall provide Primary Power and Battery status indicator for each MLS station.
- (15) The RCSU Panel shall provide a mechanism to display variable Auxiliary Data Words (specific words to be identified by the government).
- (16) The RCSU Panel shall provide the aural indicator with loudness control and silence switch.
 - (a) The range of adjustment of loudness shall be from minimum to full volume of the aural alarm.
 - (b) A control (separate from the loudness control) shall be provided to set the minimum volume of the aural indicator.
 - (c) The silence switch shall be a momentary type which will silence the current alarm, reset upon release, and then automatically re-arm to be ready for the next aural indication.
 - (d) All aural indications from an equipment that is under maintenance control shall not be annunciated at the RCSU panel.
- (17) The RCSU Panel shall provide intensity controls for lamps and indicators which satisfy the requirements of 3.3.7.
- (18) The RCSU Panel shall provide a Power ON/OFF switch for the Control/Status Panel.
- (19) The RCSU Panel shall provide a panel test capability for aural and visual indications.
- (20) Features (3), (4), (5), (6), (7) and (9) shall be available for MLS equipment(s) only when they are under Operational Control mode as defined in 3.2.1.6.3.

3.2.1.5.1.2.2 Physical requirements.

- (1) The RCSU panel unit shall be completely enclosed in a housing which has maximum dimensions behind the front panel of 4 inches wide by 6 inches high, and does not exceed a depth of 7 inches.
- (2) The front panel, including mounting flanges, shall not exceed a width of 4.5 inches and a height of 7.5 inches.
- (3) It shall be constructed so that (at the government's option) it may be mounted in a cutout in a console, or placed on a desk, table, or bench top.
- (4) The RCSU panel shall require no more than .31 KVA of electrical power.
- (5) The RCSU shall operate on a nominal 120/240 volt, 47 - 63 Hz, single-phase AC power source.
- (6) The RCSU Panel shall be design to mount in a standard 19 inch rack in accordance with FAA-G-2100, paragraph 3.3.3.2.2.

3.2.1.5.2 Remote Status Unit (RSU). The RSU shall be capable of providing status information on the Azimuth (Approach and Back), Elevation (Online and Offline) and DME/P (Online and Offline equipments).

3.2.1.5.2.1 Interface requirements. The RSU shall be designed and constructed to operate and interface with the MLS RCSU electronics unit (REU) in accordance with 3.2.2.2.

3.2.1.5.2.2 Display features. The following are the minimum set of features which will be provided.

- (1) The RSU Panel shall provide visual indicators for the MLS Ground System including Normal (Green), Secondary Alerts (Appendix A) (Yellow), and Integrity Alarms (Appendix A) (Red).
- (2) The RSU Panel shall provide separate status indications for each MLS equipment including OFF, Normal, Secondary Alert, Integrity Alarm and Control Status (Operational or Maintenance).
 - (a) All visual indications, except for Control Status, from an equipment that is under maintenance control shall not be displayed at the RSU Panel.
- (3) The RSU Panel shall provide aural indications for Secondary Alerts and Integrity Alarms.
- (4) The RSU Panel shall provide CAT I/II/III system level status (where appropriate) as defined in 3.2.1.6.4.3.

3.2.1.5.1.2.2 Physical requirements.

- (1) The RCSU panel unit shall be completely enclosed in a housing which has maximum dimensions behind the front panel of 4 inches wide by 6 inches high, and does not exceed a depth of 7 inches.
- (2) The front panel, including mounting flanges, shall not exceed a width of 4.5 inches and a height of 7.5 inches.
- (3) It shall be constructed so that (at the government's option) it may be mounted in a cutout in a console, or placed on a desk, table, or bench top.
- (4) The RCSU panel shall require no more than .31 KVA of electrical power.
- (5) The RCSU shall operate on a nominal 120/240 volt, 47 - 63 Hz, single-phase AC power source.
- (6) The RCSU Panel shall be design to mount in a standard 19 inch rack in accordance with FAA-G-2100, paragraph 3.3.3.2.2.

3.2.1.5.2 Remote Status Unit (RSU). The RSU shall be capable of providing status information on the Azimuth (Approach and Back), Elevation (Online and Offline) and DME/P (Online and Offline equipments).

3.2.1.5.2.1 Interface requirements. The RSU shall be designed and constructed to operate and interface with the MLS RCSU electronics unit (REU) in accordance with 3.2.2.2.

3.2.1.5.2.2 Display features. The following are the minimum set of features which will be provided.

- (1) The RSU Panel shall provide visual indicators for the MLS Ground System including Normal (Green), Secondary Alerts (Appendix A) (Yellow), and Integrity Alarms (Appendix A) (Red).
- (2) The RSU Panel shall provide separate status indications for each MLS equipment including OFF, Normal, Secondary Alert, Integrity Alarm and Control Status (Operational or Maintenance).
 - (a) All visual indications, except for Control Status, from an equipment that is under maintenance control shall not be displayed at the RSU Panel.
- (3) The RSU Panel shall provide aural indications for Secondary Alerts and Integrity Alarms.
- (4) The RSU Panel shall provide CAT I/II/III system level status (where appropriate) as defined in 3.2.1.6.4.3.

- (5) The panel shall have 4 cutouts, with covers, for mounting 4 RSU's.
- (6) The RSU shall require no more than .31 KVA of electrical power.
- (7) The RSU shall operate on a nominal 120/240 volt, 47 - 63 Hz., single-phase AC power source.

3.2.1.6 Equipment Control and Status.

3.2.1.6.1 Azimuth/Elevation.

- (1) The equipment shall provide appropriate reactions to inputs from the executive monitor, (as specified in 3.2.1.6.1.1).
- (2) The equipment shall provide various control and display capabilities, (as specified in 3.2.1.6.1.2).

3.2.1.6.1.1 Responses to executive monitor inputs. Integrity alarms and secondary alerts in the azimuth/elevation equipments shall only be responded to as indicated below when the monitor is in the normal state (not bypassed (Appendix A)).

3.2.1.6.1.1.1 Integrity alarms.

- (1) In response to an integrity alarm, the following shall occur.
 - (a) The equipment shall cause radiation to cease within the time limits specified in 3.2.1.7.1.1(2).
 - (b) The equipment shall complete the actions of 3.2.1.6.1.1.1.1 or 3.2.1.6.1.1.1.2.
 - (c) The equipment shall complete the control actions in Table 12 within 1 second from the time at which erroneous signal radiation was inhibited.
- (2) Cessation of radiation shall occur only when the monitor is not bypassed.

3.2.1.6.1.1.1.1 Standby status. Where secondary equipment is available for use, the equipment will initiate the following actions.

- (1) The equipment shall switchover to secondary equipment and initialize executive monitors as required.

TABLE 12 EQUIPMENT CONTROL ACTIONS (NON-STANDBY CONFIGURATIONS).

FUNCTION RESPONSE'

INTEGRITY ALARM ON:	APP. AZIMUTE	BACK AZIMUTH	ELEVATION	BDW 1,2,3	BDW 4 (AZ)	BDW 4 (BAZ)	BDW 5 (AZ')	BDW 5 (BAZ)	BDW 6 (AZ)	BDW 6 (BAZ)	DME/P IA	DME/P FA	ADW A1	ADW A2	ADW A3 (AZ)	ADW A3 (BAZ)	ADW A4 (AZ)	ADW A4 (BAZ)
APP. AZIMUTH'	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BACK AZIMUTH ²	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X
ELEVATION'	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASIC DATA WORDS 1,2,3	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 4 (AZ)'	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 4 (BAZ)	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X
BASIC DATA WORD 5 (AZ)	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 5 (BAZ)	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X
BASIC DATA WORD 6 (AZ)	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 6 (BAZ)	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X

TABLE 12 EQUIPMENT CONTROL ACTIONS (NON-STANDBY CONFIGURATIONS).

FUNCTION RESPONSE'

INTEGRITY ALARM ON:	APP. AZIMUTH	BACK AZIMUTH	ELEVATION	BDW 1,2,3	BDW 4 (AZ)	BDW 4 (BAZ)	BDW 5 (AZ')	BDW 5 (BAZ)	BDW 6 (AZ)	BDW 6 (BAZ)	DME/P IA	DME/P FA	ADW A1	ADW A2	ADW A3 (AZ)	ADW A3 (BAZ)	ADW A4 (AZ)	ADW A4 (BAZ)
APP. AZIMUTH'	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BACKAZIMUTH ²	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X
ELEVATION'	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASIC DATA WORDS 1,2,3	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 4 (AZ)'	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 4 (BAZ)	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X
BASIC DATA WORD 5 (AZ)	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 5 (BAZ)	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X
BASIC DATA WORD 6 (AZ)	X	0	X	X	X	0	X	0	X	0	0	0	X	X	X	0	X	0
BASIC DATA WORD 6 (BAZ)	0	X	0	0	0	X	0	X	0	X	0	0	0	0	0	X	0	X

TABLE 12 (CONTINUED)

Notes:

- ¹ X = cease radiation, O = continue radiation
- ² Integrity alarms can occur on any of the following parameters - mean angle error, preamble ERP, scanning beam ERP, preamble codes, OCI ERP, TDM Synchronization (BAZ only), peak dynamic sidelobe ERP, erroneous signals between functions.
- ³ Integrity alarms can occur on any of the following parameters - mean angle error, preamble ERP, scanning beam ERP, preamble codes, OCI ERP, TDM Synchronization, peak dynamic sidelobe ERP, erroneous signals between functions.
- ⁴ The functions noted in parenthesis indicate the station from which a particular data word is transmitted.
- ⁵ See Table 13.

TABLE 12 (CONTINUED)

Notes:

- ¹ X = cease radiation, O = continue radiation
- ² Integrity alarms can occur on any of the following parameters - mean angle error, preamble ERP, scanning beam ERP, preamble codes, OCI ERP, TDM Synchronization (BAZ only), peak dynamic sidelobe ERP, erroneous signals between functions.
- ³ Integrity alarms can occur on any of the following parameters - mean angle error, preamble ERP, scanning beam ERP, preamble codes, OCI ERP, TDM Synchronization, peak dynamic sidelobe ERP, erroneous signals between functions.
- ⁴ The functions noted in parenthesis indicate the station from which a particular data word is transmitted.
- ⁵ See Table 13.

- (2) The equipment shall provide integrity alarm indications to the Local Control and Status Unit (LCSU), RCSU panel, RSU and REU such that aural and visual alarms are annunciated/displayed within 1 second from the time at which erroneous signal radiation was inhibited.
- (3) The equipment shall provide the cause, (i.e., the monitored parameter), of the integrity alarm to the RMS.

3.2.1.6.1.1.1.2 Non-standby status. Where secondary equipment is not available, the equipment shall initiate the following actions:

- (1) The equipment, when in operational control, shall attempt an automatic restart after 20 (-0, +5) seconds, and again after 5 (-0, +5 seconds) minutes if 20 second restart was unsuccessful.
 - (a) A restart shall be considered successful if operation continues for a 2 minute period with no alarms.
 - (b) Automatic restart shall be canceled if any command is initiated on the failed equipment while restart is pending.
- (2) The equipment shall provide integrity alarm indications to the Local Control and Status Unit (LCSU), RCSU panel, RSU and REU such that aural and visual alarms are annunciated/displayed within 1 second from the time at which erroneous signal radiation was inhibited.
- (3) The equipment shall provide the cause, (i.e., the monitor parameter) of the initial integrity alarm to the RMS.

3.2.1.6.1.1.2 Secondary alerts.

- (1) In response to a secondary alert, the equipment shall cause radiation of the erroneous function to cease within the time limits specified in 3.2.1.7.1.1(2).
 - (a) In standby status, a secondary alert shall not cause shutdown of the primary and switchover to the secondary equipment.
- (2) The equipment shall provide secondary alert indications to the Local Control and Status Unit (LCSU), RCSU panel, RSU and REU such that aural and visual alarms are annunciated/displayed within 1 second from the time at which erroneous signal radiation was inhibited.
- (3) In response to a secondary alert, the equipment shall provide the cause, (i.e., monitored parameter), of the secondary alert to the RMS.

3.2.1.6.1.2 Local control and display features. The following minimum local control and display features will be provided.

- (1) The LCSU panel shall provide on/off equipment control for the equipment.
- (2) The LCSU panel shall provide a equipment restart (Appendix A).
- (3) The LCSU panel shall provide status indicators, for each state and mode with colors indicated:
 - (a) Green - Primary Equipment (Appendix A) selected, Configuration selected (AZ or BAZ), Monitor on, Operational Control;
 - (b) Yellow - Secondary Alert, Maintenance Warning, Secondary Equipment selected, Monitor Bypass (Appendix A), Maintenance Control, Offline Equipment;
 - (c) Red - Integrity Alarm.
- (4) The LCSU panel shall provide a redesignate Primary Equipment (Appendix A) switch.
- (5) The LCSU panel shall provide aural and visual alarms with panel test capability.
- (6) The LCSU panel shall provide a aural alarm reset switch.
- (7) The LCSU panel shall provide a PMDT interface as defined in 3.2.3.3.2.
- (8) Features (1), (2), and (4) shall be available only when the associated equipment is in maintenance control.

3.2.1.6.2 DME/P.

- (1) The equipment shall provide appropriate reactions to inputs from the executive monitor, (as specified in 3.2.1.6.2.1).
- (2) The equipment shall provide various control and display capabilities, (as specified in 3.2.1.6.2.2).

3.2.1.6.2.1 Responses to executive monitor inputs. Integrity alarms in the DME/P equipment shall only be responded to as indicated below when the monitor is in the normal state (not bypassed).

3.2.1.6.2.1.1 Integrity alarms.

- (1) In response to an integrity alarm, the following shall occur.

3.2.1.6.1.2 Local control and display features. The following minimum local control and display features will be provided.

- (1) The LCSU panel shall provide on/off equipment control for the equipment.
- (2) The LCSU panel shall provide a equipment restart (Appendix A).
- (3) The LCSU panel shall provide status indicators, for each state and mode with colors indicated:
 - (a) Green - Primary Equipment (Appendix A) selected, Configuration selected (AZ or BAZ), Monitor on, Operational Control;
 - (b) Yellow - Secondary Alert, Maintenance Warning, Secondary Equipment selected, Monitor Bypass (Appendix A), Maintenance Control, Offline Equipment;
 - (c) Red - Integrity Alarm.
- (4) The LCSU panel shall provide a redesignate Primary Equipment (Appendix A) switch.
- (5) The LCSU panel shall provide aural and visual alarms with panel test capability.
- (6) The LCSU panel shall provide a aural alarm reset switch.
- (7) The LCSU panel shall provide a PMDT interface as defined in 3.2.3.3.2.
- (8) Features (1), (2), and (4) shall be available only when the associated equipment is in maintenance control.

3.2.1.6.2 DME/P.

- (1) The equipment shall provide appropriate reactions to inputs from the executive monitor, (as specified in 3.2.1.6.2.1).
- (2) The equipment shall provide various control and display capabilities, (as specified in 3.2.1.6.2.2).

3.2.1.6.2.1 Responses to executive monitor inputs. Integrity alarms in the DME/P equipment shall only be responded to as indicated below when the monitor is in the normal state (not bypassed).

3.2.1.6.2.1.1 Integrity alarms.

- (1) In response to an integrity alarm, the following shall occur.

3.2.1.6.2.2 Local control and display features. The following minimum local control and display features will be provided.

- (1) The LCSU panel shall provide on/off control for the equipment.
- (2) The LCSU panel shall provide an equipment restart.
- (3) The LCSU panel shall provide status indicators, for each state and mode with colors indicated:
 - (a) Green - Primary Equipment selected, Monitor on, IA and FA Mode ON AIR, Operational Control;
 - (b) Yellow - Maintenance Warning, Secondary Equipment selected, Monitor Bypass (Appendix A), Maintenance Control, Offline equipment;
 - (c) Red - Integrity Alarm.
- (4) The LCSU panel shall provide a Redesignate Primary Equipment switch.
- (5) The LCSU panel shall provide aural and visual alarms with panel test capability.
- (6) The LCSU panel shall provide a aural alarm reset switch.
- (7) The LCSU panel shall provide a PMDT interface as defined in 3.2.3.3.2.
- (8) Features (1), (2) and (4) shall be available only when the associated equipment is in maintenance control.

3.2.1.6.3 MLS Control. The MLS Ground System shall be capable of initiating the proper control actions in response to integrity alarms and coordinating equipment control at all system operator interfaces.

3.2.1.6.3.1 Control actions. In response to integrity alarms the MLS shall initiate the appropriate control actions as defined in Table 12.

3.2.1.6.3.2 Control modes.

- (1) Each MLS equipment shall have the capability of functioning in either of two different control modes. These are operational control and maintenance control.
- (2) In operational control, control mastership shall reside at the RCSU panel.

- (a) If the equipment is also radiating it shall be radiating in the normal mode.
- (3) In maintenance control, control mastership shall reside at a location other than the RCSU panel. This may be at any PMDT or at the MPS when control is granted under level 2 and 3 security.
 - (a) When the equipments are radiating and in maintenance control, they shall be radiating in test mode.
 - (b) In test mode, the status bits for the appropriate functions shall transmit "0" in Basic Data Word 2, and Basic Data Word 5 for Back Azimuth, when used.
 - (i) The parameters in the angle equipment monitor shall be changed to monitor the change in status bits.
 - (c) In DME/P test mode the Morse Code Identification and replies to external interrogations shall be inhibited.
 - (i) The parameters in the DME/P monitor shall be changed appropriately to account for the fact that morse code can not be monitored in this mode.

3.2.1.6.3.3 Control mastership. Only one system operator interface (the control master) shall be granted access to the control commands available for an equipment. System operator interfaces include the RCSU panel, associated LCSU panels and PMDT interfaces; and the MPS. 3.2.1.8.4.5 defines the RMS commands that are available at each equipment, for which control mastership is required.

3.2.1.6.3.4 Coordination principles and procedures.

- (1) Requests for maintenance control shall only be processed, as described below, when maintenance control access is not locked out at the RCSU Panel.
- (2) Requests to gain control mastership of an equipment shall be annunciated on the RCSU panel.
- (3) Equipment control resulting from a single Maintenance Control Mastership Request, when granted, shall be in accordance with Table 14.
- (4) More than one Maintenance Control Mastership Requests to gain control of multiple equipments shall be allowed.

- (a) If the equipment is also radiating it shall be radiating in the normal mode.
- (3) In maintenance control, control mastership shall reside at a location other than the RCSU panel. This may be at any PMDT or at the MPS when control is granted under level 2 and 3 security.
 - (a) When the equipments are radiating and in maintenance control, they shall be radiating in test mode.
 - (b) In test mode, the status bits for the appropriate functions shall transmit "0" in Basic Data Word 2, and Basic Data Word 5 for Back Azimuth, when used.
 - (i) The parameters in the angle equipment monitor shall be changed to monitor the change in status bits.
 - (c) In DME/P test mode the Morse Code Identification and replies to external interrogations shall be inhibited.
 - (i) The parameters in the DME/P monitor shall be changed appropriately to account for the fact that morse code can not be monitored in this mode.

3.2.1.6.3.3 Control mastership. Only one system operator interface (the control master) shall be granted access to the control commands available for an equipment. System operator interfaces include the RCSU panel, associated LCSU panels and PMDT interfaces; and the MPS. 3.2.1.8.4.5 defines the RMS commands that are available at each equipment, for which control mastership is required.

3.2.1.6.3.4 Coordination principles and procedures.

- (1) Requests for maintenance control shall only be processed, as described below, when maintenance control access is not locked out at the RCSU Panel.
- (2) Requests to gain control mastership of an equipment shall be annunciated on the RCSU panel.
- (3) Equipment control resulting from a single Maintenance Control Mastership Request, when granted, shall be in accordance with Table 14.
- (4) More than one Maintenance Control Mastership Requests to gain control of multiple equipments shall be allowed.

- (5) When the RCSU panel is the control master for an equipment, the RCSU operator shall have the option to grant or deny control mastership.
- (6) If the RCSU operator takes no action, control mastership shall be automatically granted five minutes (±10 seconds) after the request is received by the REU.
- (7) Maintenance Control shall be available at a PMDT connected to an equipment in the event of a failure of communications between that equipment and the REU.
- (8) When control mastership is relinquished for an equipment, operational control shall automatically be restored to the RCSU Panel.
- (9) If an equipment is not under operational control at the time a request is made, transfer of control shall not be possible until control of that equipment is transferred back to the RCSU Panel.

3.2.1.6.3.5 Operating modes, states, and allowable commands.

- (1) Each MLS equipment shall operate in normal, test, and reconfigure equipment modes.
- (2) Within each equipment mode, the equipment shall operate in a combination of states.
- (3) The equipment shall be capable of responding to commands based on the control master as defined in Tables 15, 16, and 17.
- (4) Each table entry shall be an allowed equipment configuration which is comprised of a mode and combination of states.
- (5) Transitions between configurations shall occur as a result of allowed command responses and reactions to integrity alarm conditions.
- (6) The tables and corresponding text specifically address Category III configurations.
 - (a) Category II configurations shall be equivalent to Category III equipment configurations for which the equipment is the secondary, and the Redesignate Primary Equipment command is not available.

The following paragraphs further define the configurations. The paragraph titles contain each configuration's equipment mode, followed by a combination of states. During reconfigure, the equipments are in the process of changing states as defined in 3.2.1.8.4.5.5.

3.2.1.6.3.5.1 Normal Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall be radiating guidance information in the normal mode, with all monitored integrity parameters within tolerance limits.
- (2) The primary equipment shall be operating.
- (3) A failure shall result in switchover to the secondary equipment where provided.
- (4) The equipment shall respond to the commands listed in Table 15, Configuration Number 1.

3.2.1.6.3.5.2 Normal Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall be radiating guidance information in the normal mode, with all monitored integrity parameters within tolerance limits.
- (2) The secondary equipment where provided shall be operating.
- (3) Failure of the secondary shall result in shutdown.
- (4) The equipment shall respond to the commands listed in Table 15, Configuration Number 2.

3.2.1.6.3.5.3 Normal Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The approach azimuth shall contain one or more integrity alarms in the secondary equipment.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 3.

3.2.1.6.3.5.1 Normal Azimuth: On, Primary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall be radiating guidance information in the normal mode, with all monitored integrity parameters within tolerance limits.
- (2) The primary equipment shall be operating.
- (3) A failure shall result in switchover to the secondary equipment where provided.
- (4) The equipment shall respond to the commands listed in Table 15, Configuration Number 1.

3.2.1.6.3.5.2 Normal Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall be radiating guidance information in the normal mode, with all monitored integrity parameters within tolerance limits.
- (2) The secondary equipment where provided shall be operating.
- (3) Failure of the secondary shall result in shutdown.
- (4) The equipment shall respond to the commands listed in Table 15, Configuration Number 2.

3.2.1.6.3.5.3 Normal Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The approach azimuth shall contain one or more integrity alarms in the secondary equipment.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 3.

Table 15 NOTES

(1) COMMANDS are those commands which are normally available at either the RCSU panel or at the RMMS Interface. A Yes entry indicates that this command shall be executed by the equipment in that specific configuration. A No entry indicates that this command shall not be executed by the equipment in that configuration. The letters used in the Tables correspond with the commands as follows.

A: Equipment On	G: Return Monitor to Normal
B: Equipment Off	H: Initiate End-To-End Integrity Check
C: Redesignate Primary Equipment	I: Initiate Diagnostics
D: Initiate Equipment Restart	J: Request Maintenance Control
E: Runway Reconfigure	K: Relinquish Maintenance Control
F: Initiate Monitor Bypass	L: Initiate Automatic Integrity Checks

(2) The designated equipment (primary or secondary) for an equipment in the Off state does not indicate the equipment that will operate when the equipment is turned On. For Category III configurations, when an equipment is turned on, it shall first try to operate with the primary.

(3) A Yes/No entry in the integrity alarm column indicates that an alarm condition may exist and does not imply that it is indicated on status panels or reported by the RMS. Alarms (integrity alarms, secondary alerts and maintenance warnings) occurring while an equipment is in test mode shall not be indicated on the status panels (RCSU, RSU, LCSU, and REU) and no associated messages shall be generated by the RMS. In the test mode, monitor normal state, integrity alarms shall result in either equipment shutdown or switch to secondary equipment. In the test mode, monitor bypass state, integrity alarm, secondary alerts and maintenance warning conditions shall continue to be detected, however no control actions shall be affected when integrity alarms occur. For Category III configurations, integrity alarms may exist for the non-operational or non-designated equipments. Maintenance warnings and secondary alerts may exist in all configurations.

(4) The designated monitor state (normal or bypass) for an equipment in the Off state indicates that the monitor shall operate in that state when the equipment is turned On and does not indicate that the monitor is active in the Off state.

(5) Test mode is defined as follows. The status bits in Basic Data Words 2 and 5 shall indicate test mode. In the DME/P equipment the morse code identification and replies to external interrogations are inhibited; all other functions operate normally. In this mode the parameters in the angle equipment monitor will be changed to monitor the change in status bits. The parameters in the DME/P monitor will be changed appropriately to account for the fact that the morse code can not be monitored in this mode.

(6) For Category II equipment, only the states listed for the Primary Equipment apply.

3.2.1.6.3.5.4 Normal Azimuth: Off. Primary. No Integrity Alarms. Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands as listed in Table 15, Configuration Number 4.

3.2.1.6.3.5.5 Normal Azimuth: Off. Secondary. No Integrity Alarms. Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands as listed in Table 15, Configuration Number 5.

3.2.1.6.3.5.6 Normal Back Azimuth: On. Primary. No Integrity Alarms. Monitor Normal.

- (1) The azimuth equipment shall be radiating normal mode back azimuth guidance information with all monitored integrity parameters within monitor limits.
- (2) The primary equipment shall be operating.
- (3) Failure of the primary shall result in switchover to the secondary where provided.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 6.

3.2.1.6.3.5.7 Normal Back Azimuth: On. Secondary. No Integrity Alarms. Monitor Normal.

- (1) The azimuth equipment shall be radiating normal mode back azimuth guidance information with all monitored integrity parameters within monitor limits.
- (2) The secondary equipment shall be operating.
- (3) Failure of the secondary shall result in shutdown.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 7.

3.2.1.6.3.5.4 Normal Azimuth: Off. Primary. No Integrity Alarms. Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands as listed in Table 15, Configuration Number 4.

3.2.1.6.3.5.5 Normal Azimuth: Off. Secondary. No Integrity Alarms. Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands as listed in Table 15, Configuration Number 5.

3.2.1.6.3.5.6 Normal Back Azimuth: On. Primary. No Integrity Alarms. Monitor Normal.

- (1) The azimuth equipment shall be radiating normal mode back azimuth guidance information with all monitored integrity parameters within monitor limits.
- (2) The primary equipment shall be operating.
- (3) Failure of the primary shall result in switchover to the secondary where provided.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 6.

3.2.1.6.3.5.7 Normal Back Azimuth: On. Secondary. No Integrity Alarms. Monitor Normal.

- (1) The azimuth equipment shall be radiating normal mode back azimuth guidance information with all monitored integrity parameters within monitor limits.
- (2) The secondary equipment shall be operating.
- (3) Failure of the secondary shall result in shutdown.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 7.

- (3) Failure of the primary shall result in switchover to the secondary where provided.
- (4) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 12).

3.2.1.6.3.5.13 Test Azimuth: On, Primary, Integrity Alarms, Monitor Bypass.

- (1) The azimuth equipment shall be radiating approach azimuth guidance information in test mode.
- (2) The primary equipment shall be operating.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 13.

3.2.1.6.3.5.14 Test Azimuth: On, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The azimuth equipment shall be radiating approach azimuth guidance information in test mode. All monitored integrity parameters are within monitor limits.
- (2) The secondary equipment shall be operating.
- (3) Failure of the secondary shall result in shutdown (monitor is normal).
- (4) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 14).

3.2.1.6.3.5.15 Test Azimuth: On, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The azimuth equipment shall be radiating approach azimuth guidance information in test mode.
- (2) The secondary equipment shall be operating.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 15.

3.2.1.6.3.5.16 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The approach azimuth shall contain one or more integrity alarms.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 16).

3.2.1.6.3.5.17 Test Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 17).

3.2.1.6.3.5.18 Test Azimuth: Off, Primary, Integrity Alarms, Monitor Bypass.

- (1) The approach azimuth shall not be radiating. It may contain integrity alarms.
- (2) The designated equipment shall be the primary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 18.

3.2.1.6.3.5.19 Test Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 19).

3.2.1.6.3.5.20 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The approach azimuth shall not be radiating. It may contain integrity alarms.

3.2.1.6.3.5.16 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The approach azimuth shall contain one or more integrity alarms.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 16).

3.2.1.6.3.5.17 Test Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 17).

3.2.1.6.3.5.18 Test Azimuth: Off, Primary, Integrity Alarms, Monitor Bypass.

- (1) The approach azimuth shall not be radiating. It may contain integrity alarms.
- (2) The designated equipment shall be the primary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 18.

3.2.1.6.3.5.19 Test Azimuth: Off, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The approach azimuth shall not be radiating.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 19).

3.2.1.6.3.5.20 Test Azimuth: Off, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The approach azimuth shall not be radiating. It may contain integrity alarms.

3.2.1.6.3.5.24 Test Back Azimuth: On, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The azimuth equipment shall be radiating back azimuth guidance information in test mode.
- (2) The secondary equipment shall be operating. Integrity alarms may exist.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 24.

3.2.1.6.3.5.25 Test Back Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The back azimuth shall not be radiating.
- (2) The back azimuth shall contain one or more integrity alarms.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 25).

3.2.1.6.3.5.26 Test Back Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The back azimuth shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 26).

3.2.1.6.3.5.27 Test Back Azimuth: Off, Primary, Integrity Alarms, Monitor Bypass.

- (1) The back azimuth shall not be radiating. It may have integrity alarms.
- (2) The designated equipment shall be the primary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 27.

3.2.1.6.3.5.24 Test Back Azimuth: On, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The azimuth equipment shall be radiating back azimuth guidance information in test mode.
- (2) The secondary equipment shall be operating. Integrity alarms may exist.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 24.

3.2.1.6.3.5.25 Test Back Azimuth: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The back azimuth shall not be radiating.
- (2) The back azimuth shall contain one or more integrity alarms.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 25).

3.2.1.6.3.5.26 Test Back Azimuth: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The back azimuth shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands listed in Table 15, for the appropriate control master (Configuration Number 26).

3.2.1.6.3.5.27 Test Back Azimuth: Off, Primary, Integrity Alarms, Monitor Bypass.

- (1) The back azimuth shall not be radiating. It may have integrity alarms.
- (2) The designated equipment shall be the primary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 15, Configuration Number 27.

3.2.1.6.3.5.32 Normal Elevation: On, Secondary, No Integrity Alarms,
Monitor Normal.

- (1) The approach elevation shall be radiating guidance information in the normal mode, with all monitored integrity parameters within tolerance limits.
- (2) The secondary equipment where provided shall be operating.
- (3) Failure of the secondary shall result in shutdown.
- (4) The equipment shall respond to the commands listed in Table 16, Configuration Number 2.

3.2.1.6.3.5.33 Normal Elevation: Off, Secondary, Integrity Alarms,
Monitor Normal.

- (1) The approach elevation shall not be radiating.
- (2) The approach elevation shall contain one or more integrity alarms in the secondary equipment where provided, may contain integrity alarms in the primary equipment.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 3.

3.2.1.6.3.5.34 Normal Elevation: Off, Primary, No Integrity Alarms,
Monitor Normal.

- (1) The approach elevation shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall be capable of responding to the commands as listed in Table 16, Configuration Number 4.

3.2.1.6.3.5.35 Normal Elevation: Off, Secondary, No Integrity Alarms,
Monitor Normal.

- (1) The approach elevation shall not be radiating.
- (2) The designated equipment shall be the secondary.
- (3) It shall be capable of responding to the commands as listed in Table 16, Configuration Number 5.

TABLE 16 ELEVATION EQUIPMENT CONFIGURATIONS

CONTROL			STATES					COMMANDS (1)											
Control Mode	Control Master	Equipment Mode	Config. Number	On/Off	(Cat III) Equipment (2)	Integ. Alarm (3)	Monitor (4)	A	B	C	D	E	F	G	H	I	J	K	L
Operational	RCSU	Normal Approach EL	1.	On	Primary	No	Normal	No	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No
			2.	On	Secondary	No	Normal	No	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No
			3.	Off	Secondary	Yes	Normal	Yes	No	No	Yes	Yes	No	No	No	No	Yes	No	No
			4.	Off	Primary	No	Normal	Yes	No	No	No	Yes	No	No	No	No	Yes	No	No
			5.	Off	Secondary	No	Normal	Yes	No	No	No	Yes	No	No	No	No	Yes	No	No
Operational	RCSU	Normal Offline EL	6.	Off	Secondary	Yes	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
			7.	Off	Primary	No	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
			8.	Off	Secondary	No	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
Operational	RCSU	Reconfigure	9.	Off	Pri/Sec	Yes/No	Normal	No	No	No	No	No	No	No	No	No	No	No	
Maintenance & PMDT Level 3 security	MPS or PMDT	Test Approach EL	10.	on	Primary	No	Normal	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
			11.	on	Primary	Yes/No	Bypass	No	Yes	Yes	No	Yes	No	Yes	Ye.9	Yes	No	Ye.5	Yes
			12.	on	Secondary	No	Normal	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
			13.	On	Secondary	Yes/No	Bypass	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes
			14.	Off	Secondary	Yes	Normal	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No	
			15.	Off	Primary	No	Normal	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			16.	Off	Primary	Yes/No	Bypass	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
			17.	Off	Secondary	No	Normal	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			18.	Off	Secondary	Yes/No	Bypass	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Maintenance & PMDT Level 3 Security	MPS or PMDT	Test Offline EL	19.	Off	Secondary	Yes	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			20.	Off	Primary	No	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			21.	Off	Primary	Yes/No	Bypass	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
			22.	Off	Secondary	No	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			23.	Off	Secondary	Yes/No	Bypass	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Maintenance	MPS or PMDT	Reconfigure	24.	Off	Pri/Sec	Yes/No	Norm/By	No	No	No	No	No	No	No	No	No	No	No	

TABLE 16 ELEVATION EQUIPMENT CONFIGURATIONS

CONTROL			STATES					COMMANDS (1)											
Control Mode	Control Master	Equipment Mode	Config. Number	On/Off	(Cat III) Equipment	Integ. Alarm	Monitor	A	B	C	D	E	F	G	H	I	J	K	L
Operational	RCSU	Normal Approach EL			(2)	(3)	(4)												
			1.	on	Primary	No	Normal	No	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No
			2.	on	Secondary	No	Normal	No	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No
			3.	Off	Secondary	Yes	Normal	Yes	No	No	Yes	Yes	No	No	No	Yes	No	No	
			4.	Off	Primary	No	Normal	Yes	No	No	No	Yes	No	No	No	Yes	No	No	
Operational	RCSU	Normal Offline EL	5.	Off	Secondary	No	Normal	Yes	No	No	Yes	No	No	No	No	No	Yes	No	No
			6.	Off	Secondary	Yes	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
			7.	Off	Primary	No	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
			8.	Off	Secondary	No	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
Operational	RCSU	Reconfigure	9.	Off	Pri/Sec	Yes/No	Normal	No	No	No	No	No	No	No	No	No	No	No	
Maintenance & PMDT Level 3 Security	MPS or PMDT	Test Approach EL	10.	on	Primary	No	Normal	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
			11.	on	Primary	Yes/No	Bypass	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes
			12.	on	Secondary	No	Normal	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
			13.	On	Secondary	Yes/No	Bypass	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes
			14.	Off	Secondary	Yes	Normal	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No	
			15.	Off	Primary	No	Normal	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			16.	Off	Primary	Yes/No	Bypass	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
			17.	Off	Secondary	No	Normal	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			18.	Off	Secondary	Yes/No	Bypass	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Maintenance & PMDT Level 3 Security	MPS or PMDT	Test Offline EL	19.	Off	Secondary	Yes	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			20.	Off	Primary	No	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			21.	Off	Primary	Yes/No	Bypass	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
			22.	Off	Secondary	No	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			23.	Off	Secondary	Yes/No	Bypass	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Maintenance	MPS or PMDT	Reconfigure	24.	Off	Pri/Sec	Yes/No	Norm/By	No	No	No	No	No	No	No	No	No	No	No	

3.2.1.6.3.5.36 Normal Offline Elevation: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The offline elevation (Appendix A) shall not be radiating.
- (2) The offline elevation shall contain one or more integrity alarms in the secondary equipment where provided, may contain integrity alarms in the primary equipment.
- (3) The designated equipment shall be the secondary.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 6.

3.2.1.6.3.5.37 Normal Offline Elevation: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The offline elevation shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands listed in Table 16, Configuration Number 7.

3.2.1.6.3.5.38 Normal Offline Elevation: Off, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The offline elevation shall not be radiating.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands listed in Table 16, Configuration Number 8.

3.2.1.6.3.5.39 Normal Elevation: Reconfigure.

- (1) The elevation shall not be radiating.
- (2) It shall not be capable of responding to any commands (Table 16, Configuration Number 9) until reconfigure has completed. Reconfigure will result in the equipment configuration changed defined in 3.2.1.8.4.5.5. Integrity alarms may exist.

3.2.1.6.3.5.40 Test Approach Elevation: On, Primary, No Integrity Alarms, Monitor Normal.

- (1) The elevation equipment shall be radiating approach elevation guidance information in test mode. All monitored integrity parameters are within monitor limits.
- (2) The primary equipment shall be operating.

- (3) Failure of the primary shall result in switchover to the secondary where provided (monitor is normal).
- (4) It shall respond to the commands listed in Table 16, for the appropriate control master (Configuration Number 10).

3.2.1.6.3.5.41 Test Approach Elevation: On, Primary, Integrity Alarms, Monitor Bypass.

- (1) The elevation equipment shall be radiating approach elevation guidance information in test mode.
- (2) The primary equipment shall be operating. Integrity alarms may exist.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 11.

3.2.1.6.3.5.42 Test Approach Elevation: On, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The elevation equipment shall be radiating approach elevation guidance information in test mode. All monitored integrity parameters are within monitor limits.
- (2) Failure of the secondary shall result in shutdown (monitor is normal).
- (3) It shall respond to the commands listed in Table 16, for the appropriate control master (Configuration Number 12).

3.2.1.6.3.5.43 Test Approach Elevation: On, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The elevation equipment shall be radiating approach elevation guidance information in test mode.
- (2) The secondary equipment shall be operating.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 13.

- (3) Failure of the primary shall result in switchover to the secondary where provided (monitor is normal).
- (4) It shall respond to the commands listed in Table 16, for the appropriate control master (Configuration Number 10).

3.2.1.6.3.5.41 Test Approach Elevation: On, Primary, Integrity Alarms, Monitor Bypass.

- (1) The elevation equipment shall be radiating approach elevation guidance information in test mode.
- (2) The primary equipment shall be operating. Integrity alarms may exist.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 11.

3.2.1.6.3.5.42 Test Approach Elevation: On, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The elevation equipment shall be radiating approach elevation guidance information in test mode. All monitored integrity parameters are within monitor limits.
- (2) Failure of the secondary shall result in shutdown (monitor is normal).
- (3) It shall respond to the commands listed in Table 16, for the appropriate control master (Configuration Number 12).

3.2.1.6.3.5.43 Test Approach Elevation: On, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The elevation equipment shall be radiating approach elevation guidance information in test mode.
- (2) The secondary equipment shall be operating.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 13.

- (2) The designated equipment shall be the secondary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 18.

3.2.1.6.3.5.49 Test Offline Elevation: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The offline elevation shall not be radiating and may contain integrity alarms.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands listed in Table 16, for the appropriate control master (Configuration Number 19).

3.2.1.6.3.5.50 Test Offline Elevation: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The offline elevation shall not be radiating.
- (2) The designated equipment shall be the primary.
- (3) It shall respond to the commands listed in Table 16, for the appropriate control master (Configuration Number 20).

3.2.1.6.3.5.51 Test Offline Elevation: Off, Primary, Integrity Alarms, Monitor Bypass.

- (1) The offline elevation shall not be radiating. It may have integrity alarms.
- (2) The designated equipment shall be the primary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall respond to the commands listed in Table 16, Configuration Number 21.

3.2.1.6.3.5.52 Test Offline Elevation: Off, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The offline elevation shall not be radiating.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands listed in Table 16, for the appropriate control master (Configuration Number 22).

3.2.1.6.3.5.53 Test Offline Elevation: Off, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The offline elevation shall not be radiating. It may have integrity alarms.
- (2) The designated equipment shall be the secondary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall be capable of responding to the commands listed in Table 16, Configuration Number 23.

3.2.1.6.3.5.54 Test Approach Elevation: Reconfigure.

- (1) The elevation shall not be radiating.
- (2) It shall not be capable of responding to any commands (Table 16, Configuration Number 24) until reconfigure has completed. Reconfigure will result in the equipment configuration changed defined in 3.2.1.8.4.5.5. Integrity alarms may exist.

3.2.1.6.3.5.55 Normal Approach DME/P: On (IA and FA), Primary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be transponding IA and FA replies in the normal mode with all integrity parameters within monitor limits.
- (2) The primary equipment shall be operating.
- (3) A failure shall result in switchover to the secondary equipment where provided.
- (4) When no secondary is provided, failure of the FA function shall result in IA operation only; failure of the IA function shall result in immediate shutdown of the IA function and shutdown of the FA function following a 3 minute delay.
- (5) It shall respond to the commands listed in Table 17, Configuration Number 1.

3.2.1.6.3.5.56 Normal Approach DME/P: On (IA and FA), Secondary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be transponding IA and FA distance replies in the normal mode with all integrity parameters within monitor limits.
- (2) The secondary equipment shall be operating.

3.2.1.6.3.5.53 Test Offline Elevation: Off, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The offline elevation shall not be radiating. It may have integrity alarms.
- (2) The designated equipment shall be the secondary.
- (3) The equipment shall be in the monitor bypass state.
- (4) It shall be capable of responding to the commands listed in Table 16, Configuration Number 23.

3.2.1.6.3.5.54 Test Approach Elevation: Reconfigure.

- (1) The elevation shall not be radiating.
- (2) It shall not be capable of responding to any commands (Table 16, Configuration Number 24) until reconfigure has completed. Reconfigure will result in the equipment configuration changed defined in 3.2.1.8.4.5.5. Integrity alarms may exist.

3.2.1.6.3.5.55 Normal Approach DME/P: On (IA and FA), Primary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be transponding IA and FA replies in the normal mode with all integrity parameters within monitor limits.
- (2) The primary equipment shall be operating.
- (3) A failure shall result in switchover to the secondary equipment where provided.
- (4) When no secondary is provided, failure of the FA function shall result in IA operation only; failure of the IA function shall result in immediate shutdown of the IA function and shutdown of the FA function following a 3 minute delay.
- (5) It shall respond to the commands listed in Table 17, Configuration Number 1.

3.2.1.6.3.5.56 Normal Approach DME/P: On (IA and FA), Secondary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be transponding IA and FA distance replies in the normal mode with all integrity parameters within monitor limits.
- (2) The secondary equipment shall be operating.

TABLE 17 DME/P EQUIPMENT CONFIGURATIONS

CONTROL			STATES					COMMANDS (1)											
Control Mode	Control Master	Equipment Mode	Config. Number	On/Off	(Cat III) Equipment (2)	Integ. Alarm (3)	Monitor (4)	A	B	C	D	E	F	G	H	I	J	K	L
Operational	RCSU	Normal Approach DME/P	1.	On(IA/FA)	Primary	No	Normal	No	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No
			2.	On(IA/FA)	Secondary	No	Normal	No	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No
			3.	On(IA)	Secondary	Yes(FA)	Normal	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No	No
			4.	Off	Secondary	Yes	Normal	Yes	No	No	Yes	Yes	No	No	No	No	Yes	No	No
			5.	Off	Primary	No	Normal	Yes	No	No	No	Yes	No	No	No	No	Yes	No	No
			6.	Off	Secondary	No	Normal	Yes	No	No	No	Yes	No	No	No	No	Yes	No	No
Operational	RCSU	Normal Offline DME/P	7.	Off	Secondary	Yes	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
			8.	Off	Primary	No	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
			9.	Off	Secondary	No	Normal	No	No	No	No	Yes	No	No	No	No	Yes	No	No
Operational	RCSU	Reconfigure	10.	Off	Pri/Sec	Yes/No	Normal	No	No	No	No	No	No	No	No	No	No	No	No
Maintenance	MPS or PMDT	Test Approach DME/P	11.	On(IA/FA)	Primary	No	Normal	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
			12.	On(IA/FA)	Primary	Yes/No	Bypass	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes
			13.	On(IA/FA)	Secondary	No	Normal	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
			14.	On(IA/FA)	Secondary	Yes/No	Bypass	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes
			15.	On(IA)	Secondary	Yes(FA)	Normal	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	No
			16.	On(IA)	Secondary	Yes(FA)	Bypass	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	No
			17.	Off	Secondary	Yes	Normal	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No
			18.	Off	Primary	No	Normal	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			19.	Off	Primary	Yes/No	Bypass	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
			20.	Off	Secondary	No	Normal	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			21.	Off	Secondary	Yes/No	Bypass	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Maintenance	MPS or PMDT	Test Offline DME/P	22.	Off	Secondary	Yes	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			23.	Off	Primary	No	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			24.	Off	Primary	Yes/No	Bypass	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
			25.	Off	Secondary	No	Normal	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No
			26.	Off	Secondary	Yes/No	Bypass	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Maintenance	MPS or PMDT	Reconfigure	27.	Off	Pri/Sec	Yes/No	Norm/B	No	No	No	No	No	No	No	No	No	No	No	No

Table 17 NOTES

(1) COMMANDS are those commands which are normally available at either the RCSU panel or at the RMMS Interface. A Yes entry indicates that this command shall be executed by the equipment in that specific configuration. A No entry indicates that this command shall not be executed by the equipment in that configuration. The letters used in the Tables correspond with the commands as follows.

A: Equipment On	G: Return Monitor to Normal
B: Equipment Off	H: Initiate End-To-End Integrity Check
C: Redesignate Primary Equipment	I: Initiate Diagnostics
D: Initiate Equipment Restart	J: Request Maintenance Control
E: Runway Reconfigure	K: Relinquish Maintenance Control
F: Initiate Monitor Bypass	L: Initiate Automatic Integrity Checks

(2) The designated equipment (primary or secondary) for an equipment in the Off state does not indicate the equipment that will operate when the equipment is turned On. For Category III configurations, when an equipment is turned on, it shall first try to operate with the primary.

(3) A Yes/No entry in the integrity alarm column indicates that an alarm condition may exist and does not imply that it is indicated on status panels or reported by the RMS. Alarms (integrity alarms, secondary alerts and maintenance warnings) occurring while an equipment is in test mode shall not be indicated on the status panels (RCSU, RSU, LCSU, and REU) and no associated messages shall be generated by the RMS. In the test mode, monitor normal state, integrity alarms shall result in either equipment shutdown or switch to secondary equipment. In the test mode, monitor bypass state, integrity alarm, secondary alerts and maintenance warning conditions shall continue to be detected, however no control actions shall be affected when integrity alarms occur. For Category III configurations, integrity alarms may exist for the non-operational or non-designated equipments. Maintenance warnings and secondary alerts may exist in all configurations.

(4) The designated monitor state (normal or bypass) for an equipment in the Off state indicates that the monitor shall operate in that state when the equipment is turned On and does not indicate that the monitor is active in the Off state.

(5) Test mode is defined as follows. The status bits in Basic Data Words 2 and 5 shall indicate test mode. In the DME/P equipment the morse code identification and replies to external interrogations are inhibited; all other functions operate normally. In this mode the parameters in the angle equipment monitor will be changed to monitor the change in status bits. The parameters in the DME/P monitor will be changed appropriately to account for the fact that the morse code can not be monitored in this mode.

(6) For Category II equipment, only the states listed for the Primary Equipment apply.

Table 17 NOTES

(1) COMMANDS are those commands which are normally available at either the RCSU panel or at the RMMS Interface. A Yes entry indicates that this command shall be executed by the equipment in that specific configuration. A No entry indicates that this command shall not be executed by the equipment in that configuration. The letters used in the Tables correspond with the commands as follows.

A: Equipment On	G: Return Monitor to Normal
B: Equipment Off	H: Initiate End-To-End Integrity Check
C: Redesignate Primary Equipment	I: Initiate Diagnostics
D: Initiate Equipment Restart	J: Request Maintenance Control
E: Runway Reconfigure	K: Relinquish Maintenance Control
F: Initiate Monitor Bypass	L: Initiate Automatic Integrity Checks

(2) The designated equipment (primary or secondary) for an equipment in the Off state does not indicate the equipment that will operate when the equipment is turned On. For Category III configurations, when an equipment is turned on, it shall first try to operate with the primary.

(3) A Yes/No entry in the integrity alarm column indicates that an alarm condition may exist and does not imply that it is indicated on status panels or reported by the RMS. Alarms (integrity alarms, secondary alerts and maintenance warnings) occurring while an equipment is in test mode shall not be indicated on the status panels (RCSU, RSU, LCSU, and REU) and no associated messages shall be generated by the RMS. In the test mode, monitor normal state, integrity alarms shall result in either equipment shutdown or switch to secondary equipment. In the test mode, monitor bypass state, integrity alarm, secondary alerts and maintenance warning conditions shall continue to be detected, however no control actions shall be affected when integrity alarms occur. For Category III configurations, integrity alarms may exist for the non-operational or non-designated equipments. Maintenance warnings and secondary alerts may exist in all configurations.

(4) The designated monitor state (normal or bypass) for an equipment in the Off state indicates that the monitor shall operate in that state when the equipment is turned On and does not indicate that the monitor is active in the Off state.

(5) Test mode is defined as follows. The status bits in Basic Data Words 2 and 5 shall indicate test mode. In the DME/P equipment the morse code identification and replies to external interrogations are inhibited; all other functions operate normally. In this mode the parameters in the angle equipment monitor will be changed to monitor the change in status bits. The parameters in the DME/P monitor will be changed appropriately to account for the fact that the morse code can not be monitored in this mode.

(6) For Category II equipment, only the states listed for the Primary Equipment apply.

- (3) It shall not be capable of responding to any commands (Table 17, Configuration Number 10) until reconfigure has completed. Reconfigure will result in the equipment configuration changed defined in 3.2.1.8.4.5.5.

3.2.1.6.3.5.65 Test Approach DME/P: On (IA and FA), Primary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be operating in test mode, with all monitored integrity parameters within monitor limits.
- (2) The primary equipment shall be operating.
- (3) Failure shall result in switchover to the secondary equipment where provided.
- (4) When no secondary is provided, failure of the FA function shall result in IA operation only; failure of the IA function shall result in immediate shutdown of the IA function and shutdown of the FA function following a 3 minute delay.
- (5) It shall respond to the commands listed in Table 17, for the appropriate control master (Configuration Number 11).

3.2.1.6.3.5.66 Test Approach DME/P: On (IA and FA), Primary, Integrity Alarms, Monitor Bypass.

- (1) The DME/P equipment shall be operating in test mode. Integrity alarms may be present.
- (2) The equipment shall be in the monitor bypass state.
- (3) The primary equipment shall be operating.
- (4) It shall respond to the commands listed in Table 17, Configuration Number 12.

3.2.1.6.3.5.67 Test Approach DME/P: On (IA and FA), Secondary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be operating in test mode, with all monitored integrity parameters within monitor limits.
- (2) The secondary equipment shall be operating.
- (3) Failure of the FA function shall result in IA operation only.
- (4) Failure of the IA function shall result in immediate shutdown of IA and shutdown of FA following a 3 minute delay.

- (5) It shall respond to the commands listed in Table 17, for the appropriate control master (Configuration Number 13).

3.2.1.6.3.5.68 Test Approach DME/P: On (IA and FA), Secondary, Integrity Alarms, Monitor Bypass.

- (1) The DME/P equipment shall be operating in test mode. Integrity alarms may exist.
- (2) The equipment shall be in the monitor bypass state.
- (3) The secondary equipment shall be operating.
- (4) It shall respond to the commands listed in Table 17, Configuration Number 14.

3.2.1.6.3.5.69 Test Approach DME/P: On (IA only), Secondary, FA Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be operating in test mode, with only IA test capability.
- (2) All IA integrity parameters shall be within monitor limits with one or more integrity alarms in the FA function.
- (3) The secondary equipment shall be operating.
- (4) Failure shall result in shutdown.
- (5) It shall respond to the commands listed in Table 17, for the appropriate control master (Configuration Number 15).

3.2.1.6.3.5.70 Test Approach DME/P: On (IA only), Secondary, FA Integrity Alarms, Monitor Bypass.

- (1) The DME/P equipment shall be operating in test mode, with only IA test capability.
- (2) It shall contain one or more integrity alarms in the FA function and may contain integrity alarms in the IA function.
- (3) The equipment shall be in the monitor bypass state.
- (4) The secondary equipment shall be operating.
- (5) It shall respond to the commands listed in Table 17, Configuration Number 16.

- (5) It shall respond to the commands listed in Table 17, for the appropriate control master (Configuration Number 13).

3.2.1.6.3.5.68 Test Approach DME/P: On (IA and FA), Secondary, Integrity Alarms, Monitor Bypass.

- (1) The DME/P equipment shall be operating in test mode. Integrity alarms may exist.
- (2) The equipment shall be in the monitor bypass state.
- (3) The secondary equipment shall be operating.
- (4) It shall respond to the commands listed in Table 17, Configuration Number 14.

3.2.1.6.3.5.69 Test Approach DME/P: On (IA only), Secondary, FA Integrity Alarms, Monitor Normal.

- (1) The DME/P equipment shall be operating in test mode, with only IA test capability.
- (2) All IA integrity parameters shall be within monitor limits with one or more integrity alarms in the FA function.
- (3) The secondary equipment shall be operating.
- (4) Failure shall result in shutdown.
- (5) It shall respond to the commands listed in Table 17, for the appropriate control master (Configuration Number 15).

3.2.1.6.3.5.70 Test Approach DME/P: On (IA only), Secondary, FA Integrity Alarms, Monitor Bypass.

- (1) The DME/P equipment shall be operating in test mode, with only IA test capability.
- (2) It shall contain one or more integrity alarms in the FA function and may contain integrity alarms in the IA function.
- (3) The equipment shall be in the monitor bypass state.
- (4) The secondary equipment shall be operating.
- (5) It shall respond to the commands listed in Table 17, Configuration Number 16.

3.2.1.6.3.5.75 Test Approach DME/P: Off, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The DME/P shall not be radiating. It may contain integrity alarms.
- (2) The equipment shall be in the monitor bypass state.
- (3) It shall respond to the commands listed in Table 17, Configuration Number 21.

3.2.1.6.3.5.76 Test Offline DME/P: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The DME/P shall not be radiating. It may contain integrity alarms.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands listed in Table 17 for the appropriate control master (Configuration Number 22).

3.2.1.6.3.5.77 Test Offline DME/P: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P shall not be radiating.
- (2) It shall not contain any integrity alarms.
- (3) The designated equipment shall be the primary.
- (4) It shall respond to the commands listed in Table 17 for the appropriate control master (Configuration Number 23).

3.2.1.6.3.5.78 Test Offline DME/P: Off, Primary, Integrity Alarms, Monitor Bypass.

- (1) The DME/P shall not be radiating. It may contain integrity alarms.
- (2) The equipment shall be in the monitor bypass state.
- (3) It shall respond to the commands listed in Table 17, Configuration Number 24.

3.2.1.6.3.5.79 Test Offline DME/P: Off, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P shall not be radiating.
- (2) It shall not contain any integrity alarms.

3.2.1.6.3.5.75 Test Approach DME/P: Off, Secondary, Integrity Alarms, Monitor Bypass.

- (1) The DME/P shall not be radiating. It may contain integrity alarms.
- (2) The equipment shall be in the monitor bypass state.
- (3) It shall respond to the commands listed in Table 17, Configuration Number 21.

3.2.1.6.3.5.76 Test Offline DME/P: Off, Secondary, Integrity Alarms, Monitor Normal.

- (1) The DME/P shall not be radiating. It may contain integrity alarms.
- (2) The designated equipment shall be the secondary.
- (3) It shall respond to the commands listed in Table 17 for the appropriate control master (Configuration Number 22).

3.2.1.6.3.5.77 Test Offline DME/P: Off, Primary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P shall not be radiating.
- (2) It shall not contain any integrity alarms.
- (3) The designated equipment shall be the primary.
- (4) It shall respond to the commands listed in Table 17 for the appropriate control master (Configuration Number 23).

3.2.1.6.3.5.78 Test Offline DME/P: Off, Primary, Integrity Alarms, Monitor Bypass.

- (1) The DME/P shall not be radiating. It may contain integrity alarms.
- (2) The equipment shall be in the monitor bypass state.
- (3) It shall respond to the commands listed in Table 17, Configuration Number 24.

3.2.1.6.3.5.79 Test Offline DME/P: Off, Secondary, No Integrity Alarms, Monitor Normal.

- (1) The DME/P shall not be radiating.
- (2) It shall not contain any integrity alarms.

3.2.1.6.4.1 End-to-End Integrity Checks.

- (1) Each Azimuth equipment, Elevation equipment, and DME/P equipment shall be capable of performing end-to-end integrity checks.
- (2) As a minimum, the proper operation of each monitor, any voting logic, the control circuits, and any secondary equipment shall be verified by this check. This check need only verify those functions not verified by the automatic integrity checks defined in 3.2.1.6.4.2.
- (3) It shall be possible to initiate these checks via the RCSU panel, and at any PMDT interface and the Remote Maintenance Monitoring Subsystem (RMMS) Interface.
- (4) However, initiation of these checks shall be subject to control coordination, (i.e., only the control master can initiate the end-to-end check).
- (5) For a standby configuration, the check shall include switching between the primary and secondary equipment, verifying that the secondary equipment is operating satisfactorily and shutdown of the secondary equipment.
- (6) Failure of either the secondary equipment or the end-to-end check shall result in an integrity alarm and cause the appropriate control action.
- (7) Information shall be provided to the RMS indicating that the cause of the integrity alarm was a failure of the end-to-end check or a failure of the secondary equipment.

3.2.1.6.4.2 Automatic Integrity Checks.

- (1) Each Azimuth, Elevation and DME/P equipment shall perform automatic integrity checks (Appendix A), which ensure that out-of-tolerance conditions of all integrity and secondary parameters can be detected.
 - (a) The minimum set of integrity and secondary parameters shall be as listed in Table 18.
 - (b) The checks shall be automatically performed at least once per hour for each monitored parameter without changing the facility radiation characteristics.
 - (c) Failure of these checks shall cause an integrity alarm as defined in 3.2.1.6.1.1.1 and 3.2.1.6.2.1.1.

TABLE 18 MLS INTEGRITY AND SECONDARY PARAMETERS

<u>INTEGRITY PARAMETER</u>	<u>ALARM LIMITS</u>	<u>MAXIMUM MEASUREMENT PERIOD¹</u>	<u>SUGGESTED ASSESSMENT METHOD</u>
<u>Az/El</u> Mean Angle Error (Integral Monitor)	±10 ft. (AZ) at reference datum ±0.067° (EL)	1.0 sec	Sliding window average ²
Mean Angle Error (Field Monitor)	(Note 3)	10.0 sec	Sliding window average ²
Preamble ERP	-1.5 dB ⁴	1.0 sec	Filter ⁵
Scanning Beam ERP	-1.5 dB ⁴	1.0 sec	Filter ⁵
Essential Auxiliary Data Words	1 error	2 consecutive samples	Counter
Preamble Codes	More than 1 error	1.0 sec	Counter
Basic Data Words	1 error	2 consecutive samples	Counter
TDM Sequence Synchronization	200 μsec	1.0 sec	Counter
ERP of OCI Pulses	-1.5 dB	1 sec	Filter ⁵
Peak Dynamic Sidelobe ERP	-12 dB ⁶	10 sec	Filter ⁵
Erroneous Signals Between Functions	More than 1 error	1 sec	Counter

TABLE 18 MLS INTEGRITY AND SECONDARY PARAMETERS

<u>INTEGRITY PARAMETER</u>	<u>ALARM LIMITS</u>	<u>MAXIMUM MEASUREMENT PERIOD¹</u>	<u>SUGGESTED ASSESSMENT METHOD</u>
<u>Az/El</u> Mean Angle Er- ror (Integral Monitor)	±10 ft. (AZ) at reference datum ±0.067° (EL)	1.0 sec	Sliding window average ²
Mean Angle Er- ror (Field Monitor)	(Note 3)	10.0 sec	Sliding window average ²
Preamble ERP	-1.5 dB ⁴	1.0 sec	Filter ⁵
Scanning Beam ERP	-1.5 dB ⁴	1.0 sec	Filter ⁵
Essential Aux- iliary Data Words	1 error	2 consecutive samples	Counter
Preamble Codes	More than 1 error	1.0 sec	Counter
Basic Data Wo- rds	1 error	2 consecutive samples	Counter
TDM Sequence Synchroniza- tion	200 μsec	1.0 sec	Counter
ERP of OCI Pulses	-1.5 dB	1 sec	Filter ⁵
Peak Dynamic Sidelobe ERP	-12 dB ⁶	10 sec	Filter ⁵
Erroneous Sig- nals Between Functions	More than 1 error	1 sec	Counter

TABLE 18 (Continued)

<u>INTEGRITY PARAMETER</u>	<u>ALARM LIMITS</u>	<u>MAXIMUM MEASUREMENT PERIOD¹</u>	<u>SUGGESTED ASSESSMENT METHOD</u>
Reply Ef- ficiency Low (FA Mode)	75% ¹⁰	5 sec	Counter using test signals 1 dB above the threshold sen- sitivity val- ue.
Reply Pulse Code Error	±0.1 μsec from nominal	1 sec	Time interval measurement at the half-amp- litude point of the output pulse leading edge. ¹¹
Reply ERP/An- tenna Pat- terns	1.5 dB ⁴	1 sec	Filter ^{11,12}
Automatic In- tegrity Check Status	As determined by contractor		
End-to-End In- tegrity Check Status	As determined by contractor		
10 Spare	As determined by contractor		
<u>SECONDARY PARAMETER</u>	<u>ALERT LIMITS</u>	<u>MAXIMUM MEASUREMENT PERIOD¹</u>	<u>SUGGESTED ASSESSMENT METHOD</u>
Non-essential Auxiliary Data Words	1 error	2 consecutive samples	Counter

TABLE 18 (Continued)

<u>INTEGRITY PARAMETER</u>	<u>ALARM LIMITS</u>	<u>MAXIMUM MEASUREMENT PERIOD¹</u>	<u>SUGGESTED ASSESSMENT METHOD</u>
Reply Ef- ficiency Low (FA Mode)	75% ¹⁰	5 sec	Counter using test signals 1 dB above the threshold sen- sitivity val- ue.
Reply Pulse Code Error	±0.1 μsec from nominal	1 sec	Time interval measurement at the half-amp- litude point of the output pulse leading edge. ¹¹
Reply ERP/An- tenna Pat- terns	1.5 dB ⁴	1 sec	Filter ^{11,12}
Automatic In- tegrity Check Status	As determined by contractor		
End-to-End In- tegrity Check Status	As determined by contractor		
10 Spare	As determined by contractor		
<u>SECONDARY PARAMETER</u>	<u>ALERT LIMITS</u>	<u>MAXIMUM MEASUREMENT PERIOD¹</u>	<u>SUGGESTED ASSESSMENT METHOD</u>
Non-essential Auxiliary Data Words	1 error	2 consecutive samples	Counter

3.2.1.6.4.3 Category Status Checks.

- (1) Each MLS equipment shall identify any malfunction that affects its ability to provide the continuity of service and integrity required for Category II and III operations.
- (2) A positive indication of the status of the equipment with respect to its ability to provide Category II or III service shall be provided to the RCSU and RSU.
- (3) A degradation in Category (i.e., Cat III, II, I) of operation shall result in an integrity alarm which will be provided to the RMS, LCSU and RCSU.
- (4) The equipment shall also identify and provide the reason (e.g. faulty LRU) for a change in status to the RMS.

3.2.1.7 Executive Monitor.

3.2.1.7.1 Azimuth/elevation. The executive monitor requirements herein relate to the monitoring of the integrity of the signal in space and should not be confused with the Remote Monitoring Subsystem (RMS) which provides the interface with the Maintenance Processor Subsystem (Appendix A) (MPS). The monitoring requirements defined in this section are applicable to each Azimuth and Elevation Equipment and support the requirements of FAA-STD-022, paragraph 4.6.

3.2.1.7.1.1 Executive monitor general requirements. The executive monitor provides integrity alarms and secondary alerts to the LCSU and RMS and shall be designed such that the following apply.

- (1) Conditions that affect performance at any angle within the coverage volume shall be detected. As a minimum, degradations of the equipment characteristics which contribute to PFE and CMN will be detected as required by FAA-STD-022 and this specification.
- (2) Monitor reaction time shall take into account delays in the monitors and equipment, and periods of erroneous guidance shall not exceed 1 second.
- (3) The executive monitor hardware and software shall be sufficiently independent of the transmitter hardware and software such that the integrity requirements in 3.2.5.1.5.1.2 for Category II equipment and in 3.2.5.1.2.2 for Category III equipment can be met.

3.2.1.7.1.2 Executive monitor specific requirements.

- (1) The executive monitor shall sample the radiated signals by means of inputs from integral and field sensors (Appendix A).
- (2) The executive monitor shall indicate an integrity alarm or a secondary alert whenever the signal-in-space exceeds the limits specified in Table 18. In addition the executive monitor will satisfy the following requirements.
 - (a) Shifts in the mean angle error shall be measured by both the field and integral monitor sensors.
 - (i) The equipment shall be designed such that the integral monitor will monitor within one beamwidth of 0° for azimuth.
 - (ii) Either the integral monitor or field monitor shall monitor within one beamwidth of the minimum glide path.
 - (b) A single error shall be indicated when any one of the following messages is transmitted with one or more bit errors: (1) Function preamble; (2) Basic Data word; (3) Auxiliary Data word.
 - (c) Where required by specific equipment designs, parameters in addition to those listed in Tables 18 and 19 shall be monitored to limits and with sampling times (Appendix A) appropriate for assuring the performance requirements of FAA-STD-022 and this specification.

3.2.1.7.2 DME/P. The executive monitor requirements herein relate to the monitoring of the integrity of the signal in space and also to the integrity of the executive monitor, including its test signals.

3.2.1.7.2.1 Executive monitor general requirements.

- (1) The executive monitor shall provide integrity alarms to the LCSU and RMS.
- (2) The executive monitor shall be designed such that errors that affect performance at any point within the coverage volume are detected.
- (3) The executive monitor shall be designed such that monitor reaction times take into account delays in the monitor and equipment such that periods of erroneous guidance do not exceed one second.

3.2.1.7.1.2 Executive monitor specific requirements.

- (1) The executive monitor shall sample the radiated signals by means of inputs from integral and field sensors (Appendix A).
- (2) The executive monitor shall indicate an integrity alarm or a secondary alert whenever the signal-in-space exceeds the limits specified in Table 18. In addition the executive monitor will satisfy the following requirements.
 - (a) Shifts in the mean angle error shall be measured by both the field and integral monitor sensors.
 - (i) The equipment shall be designed such that the integral monitor will monitor within one beamwidth of 0° for azimuth.
 - (ii) Either the integral monitor or field monitor shall monitor within one beamwidth of the minimum glide path.
 - (b) A single error shall be indicated when any one of the following messages is transmitted with one or more bit errors: (1) Function preamble; (2) Basic Data word; (3) Auxiliary Data word.
 - (c) Where required by specific equipment designs, parameters in addition to those listed in Tables 18 and 19 shall be monitored to limits and with sampling times (Appendix A) appropriate for assuring the performance requirements of FAA-STD-022 and this specification.

3.2.1.7.2 DME/P. The executive monitor requirements herein relate to the monitoring of the integrity of the signal in space and also to the integrity of the executive monitor, including its test signals.

3.2.1.7.2.1 Executive monitor general requirements.

- (1) The executive monitor shall provide integrity alarms to the LCSU and RMS.
- (2) The executive monitor shall be designed such that errors that affect performance at any point within the coverage volume are detected.
- (3) The executive monitor shall be designed such that monitor reaction times take into account delays in the monitor and equipment such that periods of erroneous guidance do not exceed one second.

3.2.1.8 Remote Monitoring Subsystem (RMS).

3.2.1.8.1 Functional Requirements.

- (1) The RMS shall perform maintenance functions consisting of data acquisition and storage, data and command processing, communications with Maintenance Processing System (MPS) and PMDTs, and fault diagnosis.
- (2) The RMS shall provide the capability to certify the MLS Ground System both remotely at the MPS and locally from the PMDT.
- (3) The RMMS Interface, as defined in 3.2.3.1, shall be implemented in accordance with NAS-MD-790 and DOT/FAA/PS-89/2.

3.2.1.8.2 Data Requirements.

- (1) All measured parameter values, hard/soft alarm thresholds and equipment status shall be stored in the RMS Local Status File.
- (2) Where required by specific equipment designs, parameters in addition to those listed shall be stored.
- (3) Information stored for each parameter shall be the latest measured value or the latest filtered output, as appropriate, and parameter status.
- (4) These data shall be available upon request from the MPS and the PMDT.

3.2.1.8.2.1 Monitored Parameters.

- (1) The RMS shall sample MLS integrity and secondary parameters as listed in Table 18 and the Executive Monitor monitored maintenance parameters listed in Table 19.
- (2) In addition, the RMS shall measure the RMS monitored parameters listed in Table 19 and the environmental parameters listed in Table 20.
- (3) Where required by specific equipment designs, parameters in addition to those listed in Tables 19 and 20, shall be monitored to limits and with measurement periods appropriate for assessing the performance requirements of this specification.

3.2.1.8 Remote Monitoring Subsystem (RMS).

3.2.1.8.1 Functional Requirements.

- (1) The RMS shall perform maintenance functions consisting of data acquisition and storage, data and command processing, communications with Maintenance Processing System (MPS) and PMDTs, and fault diagnosis.
- (2) The RMS shall provide the capability to certify the MLS Ground System both remotely at the MPS and locally from the PMDT.
- (3) The RMMS Interface, as defined in 3.2.3.1, shall be implemented in accordance with NAS-MD-790 and DOT/FAA/PS-89/2.

3.2.1.8.2 Data Requirements.

- (1) All measured parameter values, hard/soft alarm thresholds and equipment status shall be stored in the RMS Local Status File.
- (2) Where required by specific equipment designs, parameters in addition to those listed shall be stored.
- (3) Information stored for each parameter shall be the latest measured value or the latest filtered output, as appropriate, and parameter status.
- (4) These data shall be available upon request from the MPS and the PMDT.

3.2.1.8.2.1 Monitored Parameters.

- (1) The RMS shall sample MLS integrity and secondary parameters as listed in Table 18 and the Executive Monitor monitored maintenance parameters listed in Table 19.
- (2) In addition, the RMS shall measure the RMS monitored parameters listed in Table 19 and the environmental parameters listed in Table 20.
- (3) Where required by specific equipment designs, parameters in addition to those listed in Tables 19 and 20, shall be monitored to limits and with measurement periods appropriate for assessing the performance requirements of this specification.

TABLE 19 (Continued)

MAINTENANCE PARAMETER	ALARM LIMITS*	MAXIMUM MEASUREMENT PERIOD	SUGGESTED MEASUREMENT METHOD	MONITORED BY ⁵
Commercial Power Current (each phase)	As determined by contractor			RMS
20 Spare	As determined by contractor			10 Monitored by Executive Moni- tor 10 Monitored by RMS
DME/P				
Transmission Rate (low)	700 pulse pairs per second	10 seconds	counter	RMS.
Interrogation Pulse Code Re- jection:				
a. Nominal Code f0.5 μ sec	More than 2 dB increase in threshold sensi- tivity value	5 seconds	Counter	RMS
b. Nominal Code ±2 μ sec	Less than 73 dB increase in threshold sensi- tivity value	5 seconds	Counter	RMS
Reply Pulse Partial Rise Time	Less than 0.2 μ sec or greater than 0.3 μ sec with 20 % linearity	10 seconds	Counter	RMS.
Reply Delay PFE:				
a. IA Mode	As determined by contractor	40 seconds	Sliding Window	Executive Monitor
b. FA Mode	As determined by contractor	10 seconds	Sliding Window	Executive Moni- tor
Control Motion Noise:				
a. IA Mode	f0.067 μ sec ¹	40 seconds	Sliding window percentile using test signals at the IA PRF 1 dB above the thres- hold sensitivity value, updated at its PRF.	RMS
b. FA Mode	f0.053 μ sec ¹	10 sec	Sliding window percentile using test signals at the FA PRF 1 dB above the thres- hold sensitivity value, updated at its PRF.	RMS

TABLE 19 (Continued)

-MAINTENANCE PARAMETER	ALARM LIMITS*	MAXIMUM MEASUREMENT PERIOD	SUGGESTED MEASUREMENT METHOD	MONITORED BY
Reply ERP/ Antenna Patterns	As determined by contractor	10 seconds	Filter	Executive Monitor
Reply Efficiency low (IA Mode)	70% ²	10 sec ³	Counter using a test signal 1 dB above the threshold sensitivity value.	RMS.
Reply Efficiency (FA Mode)	As determined by contractor	5 seconds	Counter using a test signal 1 dB above the threshold sensitivity value.	Executive Monitor
Synthesizer Frequency Lock	As determined by contractor	10 seconds	Counter	RMS
Secondary Transmitter Status (where applicable)	As determined by Contractor	1 second	N/A	RMS
FA Decode Rate	As determined by contractor	10 seconds	Counter	RMS
Reply Pulse Code Error	As determined by contractor	1 second	Time interval measurement at the half amplitude point of the output pulse leading edge.	Executive Monitor
Battery Float Voltage	As determined by contractor			RMS
B a t t e r y Equalizing Voltage	As determined by contractor			RMS
Battery Output Current	As determined by contractor			RMS
Battery Charge Rate	As determined by contractor			RMS
20 Spare	As determined by contractor			10 Monitored by RMS, 10 by Executive Monitor.

TABLE 19 (Continued)

-MAINTENANCE PARAMETER	ALARM LIMITS*	MAXIMUM MEASUREMENT PERIOD	SUGGESTED MEASUREMENT METHOD	MONITORED BY
Reply ERP/ Antenna Patterns	As determined by contractor	10 seconds	Filter	Executive Monitor
Reply Efficiency low (IA Mode)	70% ²	10 sec ³	Counter using a test signal 1 dB above the threshold sensitivity value.	RMS.
Reply Efficiency (FA Mode)	As determined by contractor	5 seconds	Counter using a test signal 1 dB above the threshold sensitivity value.	Executive Monitor
Synthesizer Frequency Lock	As determined by contractor	10 seconds	Counter	RMS
Secondary Transmitter Status (where applicable)	As determined by Contractor	1 second	N/A	RMS
FA Decode Rate	As determined by contractor	10 seconds	Counter	RMS
Reply Pulse Code Error	As determined by contractor	1 second	Time interval measurement at the half amplitude point of the output pulse leading edge.	Executive Monitor
Battery Float Voltage	As determined by contractor			RMS
B a t t e r y Equalizing Voltage	As determined by contractor			RMS
Battery Output Current	As determined by contractor			RMS
Battery Charge Rate	As determined by contractor			RMS
20 Spare	As determined by contractor			10 Monitored by RMS, 10 by Executive Monitor.

TABLE 20 MLS ENVIRONMENTAL PARAMETERS FOR EACH ENCLOSURE

Smoke and Fire Detection
Intrusion Detection
Electrical Power Status (Primary or Battery)
Environmental Control Maintenance Status (Heaters/Fans)
Equipment Enclosure Temperature
10 Spare

TABLE 20 MLS ENVIRONMENTAL PARAMETERS FOR EACH ENCLOSURE

Smoke and Fire Detection
Intrusion Detection
Electrical Power Status (Primary or Battery)
Environmental Control Maintenance Status (Heaters/Fans)
Equipment Enclosure Temperature
10 Spare

3.2.1.8.3.1 Hard/Soft Alarm Determination.

- (1) The RMS shall process Integrity Alarm and Secondary Alert indications as defined in 3.2.1.6.1.1 and 3.2.1.6.2.1 for each of the parameters listed in Table 18 as hard alarms.
- (2) For each of the parameters listed in Tables 19 and 20, the RMS shall determine that a hard/soft alarm exists when the actual value of the monitored parameter equals or exceeds the hard or soft alarm threshold values in Tables 19 and 20.
- (3) In addition to being sent to the message buffer, hard/soft alarms of Tables 19 and 20 shall sent as maintenance warnings to the REU and LCSU.
- (4) To minimize the declaration of hard/soft alarms due to transient conditions, some filtering or averaging shall be performed.
- (5) Hard/Soft alarms that occur when an equipment is under maintenance control at the PMDT shall not cause the generation of alarm messages as defined in 3.2.1.8.4.1 or state change messages as defined in 3.2.1.8.3.3.
- (6) When the equipment is returned to operational control, all uncleared (parameters that are out of tolerance) hard/soft alarms shall cause the generation of an alarm message and a parameter status change.
- (7) The RMS shall temporarily disable intrusion alarms for 2 minutes after intrusion is detected.
- (8) The intrusion hard alarms for each equipment enclosures of a MLS Ground System shall be disabled when a successful logon is performed at the portable maintenance data terminal interface of that enclosure.
- (9) The RMS shall continue to disable intrusion hard alarms for 5 minutes after a logoff at the PMDT interface has occurred.

3.2.1.8.3.2 Return To Normal Determination. The RMS shall determine that a previously reported hard/soft alarm condition no longer exists.

TABLE 21 EQUIPMENT STATUS

EQUIPMENT	CONFIGURATION	CONTROL	MAINTENANCE CONTROL ACCESS	PORTABLE TERMINAL	TRANSMITTER (1)	EQUIPMENT SELECTION	STATUS (2)
AZ1	APPROACH/ BACK	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED/ DISCONNECTED /DISABLED	A B	PRIMARY / SECONDARY PRIMARY / SECONDARY	ON/OFF/ALARM ON/OFF/ ALARM/NOT PROVIDED
AZ2	APPROACH BACK	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED/ DISCONNECTED /DISABLED	A B	PRIMARY/ SECONDARY PRIMARY / SECONDARY	ON/OFF/ALARM ON/OFF/ ALARM/NOT PROVIDED
EL1	APPROACH OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED/ DISCONNECTED /DISABLED	A B	PRIMARY/ SECONDARY PRIMARY / SECONDARY	ON/OFF/ALARM ON/OFF/ ALARM/NOT PROVIDED
EL2	APPROACH/ OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED/ DISCONNECTED /DISABLED	A B	PRIMARY/ SECONDARY PRIMARY / SECONDARY	ON/OFF/ALARM ON/OFF/ ALARM/NOT PROVIDED
DME/P1	APPROACH OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED/ DISCONNECTED /DISABLED	A B	PRIMARY/ SECONDARY PRIMARY / SECONDARY	ON/OFF/ALARM ON/OFF/ ALARM/NOT PROVIDED
DME/P2	APPROACH OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED/ DISCONNECTED /DISABLED	A B	PRIMARY / SECONDARY PRIMARY / SECONDARY	ON/OFF/ALARM ON/OFF/ ALARM/NOT PROVIDED
REU				CONNECTED/ DISCONNECTED /DISABLED			

NOTES:

(1) Transmitter B applies to Category III equipment only.

(2) STATUS:

ON: Equipment Radiating

OFF: Equipment Not Radiating

ALARM: Equipment not radiating due to an integrity alarm

NOT PROVIDED: Not a Category III configuration.

TABLE 21 EQUIPMENT STATUS

EQUIPMENT	CONFIGURATION	CONTROL	MAINTENANCE CONTROL ACCESS	PORTABLE TERMINAL	TRANSMITTER (1)	EQUIPMENT SELECTION	STATUS (2)
AZ1	APPROACH / BACK	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED DISCONNECTED /DISABLED	A B	PRIMARY / SECONDARY PRIMARY SECONDARY	ON/OFF / ALARM / NOT PROVIDED
AZ2	APPROACH / BACK	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED DISCONNECTED /DISABLED	A B	PRIMARY / SECONDARY PRIMARY SECONDARY	ON/OFF / ALARM / NOT PROVIDED
EL1	APPROACH OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED DISCONNECTED /DISABLED	A B	PRIMARY / SECONDARY PRIMARY SECONDARY	ON/OFF / ALARM / NOT PROVIDED
EL2	APPROACH / OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED DISCONNECTED /DISABLED	A B	PRIMARY SECONDARY PRIMARY SECONDARY	ON/OFF / ALARM / NOT PROVIDED
DME/P1	APPROACH OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED DISCONNECTED /DISABLED	A B	PRIMARY SECONDARY PRIMARY SECONDARY	ON/OFF / ALARM / NOT PROVIDED
DME/P2	APPROACH / OFFLINE	OPERATIONAL MAINTENANCE	LOCKED OUT/ AVAILABLE	CONNECTED DISCONNECTED /DISABLED	A B	PRIMARY / SECONDARY PRIMARY SECONDARY	ON/OFF / ALARM / NOT PROVIDED
REU				CONNECTED DISCONNECTED /DISABLED			

NOTES :

(1) Transmitter B applies to Category III equipment only.

(2) STATUS:

ON: Equipment Radiating

OFF: Equipment Not Radiating

ALARM: Equipment not radiating due to an integrity alarm

NOT PROVIDED: Not a Category III configuration.

3.2.1.8.3.5 Record of Events.

- (1) The RMS shall store in its Local Status File each out-of-tolerance parameter, each state change, and fault diagnostics result, except those occurring for an equipment under maintenance control.
- (2) Time and date of each event shall also be recorded.
- (3) Sufficient space shall be available to store up to the latest 10 hard alarms, 10 soft alarms, 10 state changes and 10 fault diagnostics results.

3.2.1.8.3.6 Timestamping. The real time clock as specified in 3.3.4.1.8 shall provide a digital output containing the year, month, day, hour, minute, and second to facilitate timestamping of events.

3.2.1.8.4 RMS/RMMS Operational Interface. The RMS shall send information to the message buffer in response to continuous, specific and scheduled polls, and in response to RMS commands and requests.

3.2.1.8.4.1 RMS Message Generation.

- (1) The RMS shall prepare and insert the following messages in the message buffer within an average time of 2 seconds and a maximum time of 5 seconds following RMS detection:
 - (a) Alarm Message,
 - (b) Return To Normal (RTN) Message,
 - (c) State Change Message,
 - (d) Terminal Message,
 - (e) Control Message,
 - (f) Command Error Message,
 - (g) Busy Status Message, and
 - (h) Site Data Report (SDR) Message.
- (2) Messages shall be prepared for transmission to the RMMS Subsystem in accordance with Table 22.
- (3) The message buffer shall hold at least 3K bytes of data.

3.2.1.8.4.2 RMS Messages. RMS messages shall be formatted as specified in DOT/FAA/PS-89/2.

3.2.1.8.4.2.1 Alarm Message. The Alarm Message shall be sent to the message buffer in response to hard and soft alarms.

3.2.1.8.4.2.2 Return to Normal Message. The Return to Normal Message shall be sent to the message buffer when a previously reported hard or soft alarm no longer exists.

3.2.1.8.4.2.3 State Change Message. The State Change Message shall be sent to the message buffer in response to a change in state as specified in 3.2.1.8.3.3.

3.2.1.8.4.2.4 Terminal Message.

- (1) The RMS shall send to the message buffer any message generated at a PMDT.
- (2) The RMS shall direct any message received from the MPS to the addressed PMDT.

3.2.1.8.4.2.5 Control messages.

- (1) The RMS shall send to the message buffer the response to a control request.
- (2) Valid responses shall be:
 - (a) Maintenance Control Granted; or
 - (b) Maintenance Control Denied.

3.2.1.8.4.2.5.1 Maintenance Control Granted.

- (1) This response shall be sent if the RCSU operator grants maintenance control at the RCSU panel.
- (2) It shall also be sent to the message buffer 5 minutes (± 10 seconds) after receipt of the request if the request is otherwise not responded to.

3.2.1.8.4.2.5.2 Maintenance control denied.

- (1) This response shall be sent if the RCSU operator denies maintenance control at the RCSU panel.
- (2) It shall also be sent if maintenance control is locked out at the RCSU panel or if the equipment is already in maintenance control by another operator.

3.2.1.8.4.2.6 Command Error Message. This message shall be sent to the message buffer when the RMS receives a correctly formatted command that violates the allowable commands specified in Tables 14, 15 and 16.

3.2.1.8.4.2.3 State Change Message. The State Change Message shall be sent to the message buffer in response to a change in state as specified in 3.2.1.8.3.3.

3.2.1.8.4.2.4 Terminal Message.

- (1) The RMS shall send to the message buffer any message generated at a PMDT.
- (2) The RMS shall direct any message received from the MPS to the addressed PMDT.

3.2.1.8.4.2.5 Control messages.

- (1) The RMS shall send to the message buffer the response to a control request.
- (2) Valid responses shall be:
 - (a) Maintenance Control Granted; or
 - (b) Maintenance Control Denied.

3.2.1.8.4.2.5.1 Maintenance Control Granted.

- (1) This response shall be sent if the RCSU operator grants maintenance control at the RCSU panel.
- (2) It shall also be sent to the message buffer 5 minutes (± 10 seconds) after receipt of the request if the request is otherwise not responded to.

3.2.1.8.4.2.5.2 Maintenance control denied.

- (1) This response shall be sent if the RCSU operator denies maintenance control at the RCSU panel.
- (2) It shall also be sent if maintenance control is locked out at the RCSU panel or if the equipment is already in maintenance control by another operator.

3.2.1.8.4.2.6 Command Error Message. This message shall be sent to the message buffer when the RMS receives a correctly formatted command that violates the allowable commands specified in Tables 14, 15 and 16.

3.2.1.8.4.2.7 Busy Status Message.

- (1) This message shall be sent to the message buffer if the RMS is busy and unable to process a RMMS poll, command or request.
 - (a) Polls, commands, and requests causing a busy status message shall not be processed.
- (2) This message shall always be generated as a result of a RMMS command or request when the RMS is under maintenance control at the PMDT.

3.2.1.8.4.2.8 Site Data Report Message.

- (1) A Site Data Report (SDR) message shall be sent to the message buffer in response to a request for the contents of a logical unit. This request will be a poll from the RMMS.
- (2) This message shall also be sent to the message buffer in response to commands as specified in 3.2.1.8.4.5 and as defined below.

3.2.1.8.4.2.8.1 End-to-End Integrity Check Results.

- (1) This SDR shall be generated upon completion of an end-to-end integrity check initiated by the RMMS.
- (2) The SDR shall contain information to indicate whether the end-to-end integrity check passed or failed.

3.2.1.8.4.2.8.2 Automatic Integrity Check Results.

- (1) This SDR shall be generated upon completion of an automatic integrity check initiated by the RMMS.
- (2) The SDR shall contain information to indicate whether the automatic integrity check passed or failed.

3.2.1.8.4.2.8.3 Diagnostics Results.

- (1) This SDR shall be generated upon completion of manually initiated diagnostics.
- (2) The SDR shall contain information to identify failed parameters along with candidate failed LRUs.
- (3) The SDR shall contain the date and time of diagnostics completion.

3.2.1.8.4.2.7 Busy Status Message.

- (1) This message shall be sent to the message buffer if the RMS is busy and unable to process a RMMS poll, command or request.
 - (a) Polls, commands, and requests causing a busy status message shall not be processed.
- (2) This message shall always be generated as a result of a RMMS command or request when the RMS is under maintenance control at the PMDT.

3.2.1.8.4.2.8 Site Data Report Message.

- (1) A Site Data Report (SDR) message shall be sent to the message buffer in response to a request for the contents of a logical unit. This request will be a poll from the RMMS.
- (2) This message shall also be sent to the message buffer in response to commands as specified in 3.2.1.8.4.5 and as defined below.

3.2.1.8.4.2.8.1 End-to-End Integrity Check Results.

- (1) This SDR shall be generated upon completion of an end-to-end integrity check initiated by the RMMS.
- (2) The SDR shall contain information to indicate whether the end-to-end integrity check passed or failed.

3.2.1.8.4.2.8.2 Automatic Integrity Check Results.

- (1) This SDR shall be generated upon completion of an automatic integrity check initiated by the RMMS.
- (2) The SDR shall contain information to indicate whether the automatic integrity check passed or failed.

3.2.1.8.4.2.8.3 Diagnostics Results.

- (1) This SDR shall be generated upon completion of manually initiated diagnostics.
- (2) The SDR shall contain information to identify failed parameters along with candidate failed LRUs.
- (3) The SDR shall contain the date and time of diagnostics completion.

3.2.1.8.4.5.1 Equipment On. This command shall cause an individual equipment (Azimuth, Elevation, Back Azimuth, DME/P) to be initialized; clear all alarms, alert conditions and monitor readings; provide any additional initialization required; and begin radiation.

3.2.1.8.4.5.2 Equipment Off. This command shall cause an individual equipment (Azimuth, Elevation, Back Azimuth, DME/P) to cease radiation.

3.2.1.8.4.5.3 Redesignate Primary Equipment.

- (1) This command shall cause the primary equipment to be redesignated as the secondary equipment and the secondary equipment to be redesignated as the primary equipment.
- (2) This command shall not affect which equipment is active.

3.2.1.8.4.5.4 Initiate Equipment Restart. This command shall cause the selected equipment to clear all alarm and alert conditions, clear all monitor readings and begin radiation in Test Mode.

3.2.1.8.4.5.5 Runway Reconfigure.

- (1) This command shall cause runway reconfigure as defined in Appendix A.
- (2) All equipments entering the Approach Mode shall also enter the ON State.
- (3) Equipment shall remain under the same control mastership after Reconfigure is executed and resume the same mode (normal or test).
 - (a) If the azimuth equipment is a Back Azimuth, this command shall cause the Back Azimuth to switch to Approach Azimuth, the offline elevation to go into the Approach Mode and the DME/P to remain in the On state.

3.2.1.8.4.5.6 RMS Security Access Change. This command shall change User Identifier (UID), levels of security access and password.

3.2.1.8.4.5.7 RMS Reset.

- (1) This command shall cause the RMS to reset.
- (2) RMS actions shall include clearing registers, resetting counters to zero, and initializing variables to starting values.

3.2.1.8.4.5.8 Initiate Monitor Bypass.

- (1) This command shall initiate monitor bypass as defined in Appendix A.

- (2) The monitor shall be returned to normal automatically when the equipment is returned to operational control.

3.2.1.8.4.5.9 Return Monitor to Normal. This command shall return the Executive Monitor to normal operation.

3.2.1.8.4.5.10 Initiate End-To-End Integrity Check.

- (1) This command shall cause the selected equipment to perform its end-to-end integrity check as defined in 3.2.1.6.4.1.
- (2) Upon completion of this command, a End-to-End Integrity Result Message shall be generated.

3.2.1.8.4.5.11 Initiate Diagnostics.

- (1) This command shall cause the selected equipment to initiate diagnostics as defined in 3.2.1.8.3.4.
- (2) Upon completion of this command, a Fault Diagnostics Result Message shall be generated.

3.2.1.8.4.5.12 Request Maintenance Control. This command shall send a request to the REU for permission to gain maintenance control of an equipment.

3.2.1.8.4.5.13 Relinquish Maintenance Control.

- (1) This command shall notify the REU that maintenance control is no longer required.
- (2) Operational control shall be returned to the RCSU.

3.2.1.8.4.5.14 Initiate Automatic Integrity Checks.

- (1) This command shall cause the selected equipment to initiate automatic integrity checks.
- (2) Upon completion of this command, a Automatic Integrity Result Message shall be generated.

3.2.2 Internal MLS interfaces.

- (1) A data communication system shall interconnect the MLS azimuth stations, elevation stations, REU(s), RCSU Panel, and the RSU(s).
- (2) The communications that shall be conducted between the equipment shall include MLS status, commands, responses, messages, and synchronization functions which are required for operation, calibration and maintenance of the MLS in accordance with this specification.

- (2) The monitor shall be returned to normal automatically when the equipment is returned to operational control.

3.2.1.8.4.5.9 Return Monitor to Normal. This command shall return the Executive Monitor to normal operation.

3.2.1.8.4.5.10 Initiate End-To-End Integrity Check.

- (1) This command shall cause the selected equipment to perform its end-to-end integrity check as defined in 3.2.1.6.4.1.
- (2) Upon completion of this command, a End-to-End Integrity Result Message shall be generated.

3.2.1.8.4.5.11 Initiate Diagnostics.

- (1) This command shall cause the selected equipment to initiate diagnostics as defined in 3.2.1.8.3.4.
- (2) Upon completion of this command, a Fault Diagnostics Result Message shall be generated.

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3.2.1.8.4.5.13 Relinquish Maintenance Control.

- (1) This command shall notify the REU that maintenance control is no longer required.
- (2) Operational control shall be returned to the RCSU.

3.2.1.8.4.5.14 Initiate Automatic Integrity Checks.

- (1) This command shall cause the selected equipment to initiate automatic integrity checks.
- (2) Upon completion of this command, a Automatic Integrity Result Message shall be generated.

3.2.2 Internal MLS interfaces.

- (1) A data communication system shall interconnect the MLS azimuth stations, elevation stations, REU(s), RCSU Panel, and the RSU(s).
- (2) The communications that shall be conducted between the equipment shall include MLS status, commands, responses, messages, and synchronization functions which are required for operation, calibration and maintenance of the MLS in accordance with this specification.

3.2.2.1.2 Multiple design interoperability.

- (1) Two MLS Ground Systems of different designs, each having been designed in accordance with this specification and installed to serve opposite ends of the same runway, shall be capable of communicating and operating with each other.
- (2) This capability shall be integral to each MLS delivered.
- (3) This capability shall in no way inhibit the proper functioning of an MLS installation when the equipment which is of the same design is installed throughout the installation.

3.2.2.1.2.1 Dual REU configuration.

- (1) The communications between MLS systems of different design shall be implemented through the use of a Dual REU Configuration (see Figure 5).
- (2) Communications between the equipment serving each runway end shall be routed through two REUs.
- (3) The same RCSU Panel and RSUs which support the Single REU Configuration shall be used to display the information from the MLS equipment located at both ends of the runway.
- (4) In addition to meeting the requirements of this specification including 3.2.2.1.1 and 3.2.1.5.1, each REU shall be capable of functioning as a Master REU or as a Slave REU.
- (5) The functional interface between the Master REU, one Azimuth Station and one Elevation Station shall be in accordance with the requirements identified in this specification.
- (6) The functional and physical interface between the Master REU and the RCSU Panel, RSUs, AUX DATA source, MPS, and the Slave REU shall be in accordance with the requirements identified in this specification.
- (7) The functional interfaces between the Slave REU, one Azimuth Station and one Elevation Station shall be in accordance with the requirements identified in this specification.
- (8) The functional and physical interface between the Master REU and the Slave REU shall be in accordance with the requirements identified in this specification. (Note that the Slave REU and the Azimuth and Elevation Stations with which it interfaces are of the same design; however, the design is different from the Master REU and the MLS stations with which it interfaces.)

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- (2) Communications between the equipment serving each runway end shall be routed through two REUs.
- (3) The same RCSU Panel and RSUs which support the Single REU Configuration shall be used to display the information from the MLS equipment located at both ends of the runway.
- (4) In addition to meeting the requirements of this specification including 3.2.2.1.1 and 3.2.1.5.1, each REU shall be capable of functioning as a Master REU or as a Slave REU.
- (5) The functional interface between the Master REU, one Azimuth Station and one Elevation Station shall be in accordance with the requirements identified in this specification.
- (6) The functional and physical interface between the Master REU and the RCSU Panel, RSUs, AUX DATA source, MPS, and the Slave REU shall be in accordance with the requirements identified in this specification.
- (7) The functional interfaces between the Slave REU, one Azimuth Station and one Elevation Station shall be in accordance with the requirements identified in this specification.
- (8) The functional and physical interface between the Master REU and the Slave REU shall be in accordance with the requirements identified in this specification. (Note that the Slave REU and the Azimuth and Elevation Stations with which it interfaces are of the same design; however, the design is different from the Master REU and the MLS stations with which it interfaces.)

- (9) Both REUs shall be capable of functioning as either the Master or Slave REU as well as being capable of functioning as a Standalone REU when both runway ends are serviced by equipment of the same design.
- (10) The REU shall not require any modification other than the resetting of either hardware or software switches which are mounted in the interior or on the exterior of the equipment to function as Standalone, Master, or Slave unit.

3.2.2.1.2.2 REU to REU communications.

- (1) The communication between the Master and Slave REUs shall be via two optical data links, each designed in accordance with EIA-533.
- (2) One link shall be full-duplex and shall transmit MLS data.
- (3) The other link shall be simplex and shall transmit the synchronization function.
- (4) The MLS shall be designed based on a optical fiber link length of thirty (30) meters maximum and one (1) meter minimum between the two REUs.
- (5) Data link protocol, data formats, and additional physical transmission requirements shall be as specified in DOT/FAA/SA-89/2.

3.2.2.2 REU/RCSU Panel/RSU interfaces.

- (1) The communication system shall provide two-way data communications between the REU, and the RCSU Panel.
- (2) The communication system shall also provide one-way data communications between the REU and each of two Remote Status Units (RSUs).
- (3) The equipment shall exchange MLS system status and control data in accordance with the requirements of 3.2.1.5.1.
- (4) The physical transmission media that shall be used to accommodate the data communication shall be wire and voice grade special access service lines as specified in 3.3.1.4.
- (5) Each RCSU and RSU shall provide interface ports for wire and voice grade special access service lines.
- (6) The REU shall provide interfaces for one RCSU Panel and two RSUs.

- (7) Each REU interface shall provide interface ports for wire and voice grade special access service lines.

3.2.3 External MLS Communication Interfaces.

- (1) The MLS shall communicate with other NAS facilities and equipment via EIA-232 interface ports.
- (2) Finger clearances for the connectors shall be in accordance with EIA-232, Annex A.
- (3) Failure of any external communications interface shall not affect MLS Ground System performance.

3.2.3.1 Remote Maintenance Monitoring System (RMMS) Communications Interface.

- (1) The MLS shall connect to the MPS via an EIA-232 communications link.
- (2) This link shall be provided by the Contractor and will consist of an EIA-232 port located on the REU.
- (3) The interface shall comply with the requirements for information coding and data link protocol as specified in DOT/FAA/PS-89/2.

3.2.3.1.1 RMMS EIA-232 port. The REU EIA-232 port shall have the following configuration, interface and performance characteristics.

- (1) The port shall provide the complete set of serial data interchange interface functional capabilities that are specified in EIA-232. For information, the REU port will be connected to, and used with, signal conversion equipment such as a modem, multiplexer, statistical multiplexer, or data concentrator in a data link to the MPS.
 - (a) The signal conversion equipment and 25 pin conductor cable required to connect to the REU RMMS EIA-232 port to the signal conversion equipment shall be provided by the government.
 - (b) Capability to select serial data interchange synchronously and nonsynchronously shall be provided.
- (2) The port shall be capable of being configured to support nonsynchronous serial data interchange at baud rates of 150, 300, 600, 1200, 2400, 4800, 9600 or 19,200 with split channel capability on any baud rate combination.

- (7) Each REU interface shall provide interface ports for wire and voice grade special access service lines.

3.2.3 External MLS Communication Interfaces.

- (1) The MLS shall communicate with other NAS facilities and equipment via EIA-232 interface ports.
- (2) Finger clearances for the connectors shall be in accordance with EIA-232, Annex A.
- (3) Failure of any external communications interface shall not affect MLS Ground System performance.

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- (1) The MLS shall connect to the MPS via an EIA-232 communications link.
- (2) This link shall be provided by the Contractor and will consist of an EIA-232 port located on the REU.
- (3) The interface shall comply with the requirements for information coding and data link protocol as specified in DOT/FAA/PS-89/2.

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- (1) The port shall provide the complete set of serial data interchange interface functional capabilities that are specified in EIA-232. For information, the REU port will be connected to, and used with, signal conversion equipment such as a modem, multiplexer, statistical multiplexer, or data concentrator in a data link to the MPS.
 - (a) The signal conversion equipment and 25 pin conductor cable required to connect to the REU RMMS EIA-232 port to the signal conversion equipment shall be provided by the government.
 - (b) Capability to select serial data interchange synchronously and nonsynchronously shall be provided.
- (2) The port shall be capable of being configured to support nonsynchronous serial data interchange at baud rates of 150, 300, 600, 1200, 2400, 4800, 9600 or 19,200 with split channel capability on any baud rate combination.

- (f) The port shall utilize the ASCII character coding defined in ANSI X3.4 and the control functions coding defined by ANSI X3.64 to support the auxiliary data communication protocol.

3.2.3.3 Portable Maintenance Data Terminal (PMDT). Each Azimuth, Elevation, DME/P, and RCSU Electronics Unit shall have an interface that allows the PMDT to communicate to the RMS.

3.2.3.3.1 PMDT Operation.

- (1) The PMDT shall provide the capability to communicate with the MPS or another PMDT, including the transmission, reception, display and printing of messages.
- (2) The PMDT shall provide the capability to initiate the commands listed in 3.2.1.8.4.5. This capability will be available only for those equipments that are under maintenance control.
- (3) The PMDT shall provide the capability to display the data listed in 3.2.3.3.3.
- (4) The PMDT shall provide the capability to receive and display control messages as specified in 3.2.1.8.4.4.

3.2.3.3.2 RMS/PMDT Physical Interface.

- (1) Each MLS equipment shall provide an EIA-232 port to allow PMDT connection to the RMS.
- (2) The characteristics of the EIA-232 port are as follows.
 - (a) The port shall be selectable as either synchronous or non-synchronous serial data exchange.
 - (b) The port shall have a selectable configuration as either a DTE or a DCE.
 - (c) The port shall be selectable and supportive of the standard interface types A through M as listed in EIA-232 section 5, figures 5-1 and 5-2.
 - (d) The port shall automatically sense and match both the parity and the baud rate, including rates of 150, 300, 1200, 2400, 4800, 9600, and 19,200 baud.
 - (e) The port shall utilize the connectors for DTE as described in the EIA-232 paragraph for Interface Connectors.

- (f) The port shall utilize the ASCII character coding defined in ANSI X3.4 and the control functions coding defined by ANSI X3.64.

3.2.3.3.3 Data Transmission and Display.

- (1) The data transmissions to the PMDT shall be in ASCII and formatted in engineering units.
- (2) The RMS shall provide to the PMDT the following options for displaying information:
 - (a) A menu of all parameters, (each parameter will be identified by its logical unit and data point);
 - (b) A list of all parameters, current values, and limits for integrity parameters, secondary parameters and maintenance parameters;
 - (c) A single parameter with current value and threshold values;
 - (d) The value of any selected parameter at nominal 10 second intervals;
 - (e) A list of the Record of Events as defined in 3.2.1.8.3.5;
 - (f) A list of the Historical Performance Record as defined in 3.2.1.8.2.5;
 - (g) Display and print the contents of basic and auxiliary data words;
 - (h) A "Help" feature to display all available functions.
- (3) The RMS shall provide the PMDT with the capability to communicate with the MPS and/or another PMDT.

3.2.4 Physical Characteristics.

3.2.4.1 Protective coatings.

- (1) Painting of all exterior surfaces shall be in accordance with FAA-STD-003, and Advisory Circular AC 70/7460-1, Obstruction Marking and Lighting, with the exception that the protective finish shall be chosen such that it will be compatible with the surface to be protected and shall preclude corrosion in the environment specified in 3.2.6.2 unless otherwise indicated in the contract. The painting requirement does not apply to radome surfaces.

- (f) The port shall utilize the ASCII character coding defined in ANSI X3.4 and the control functions coding defined by ANSI X3.64.

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- (1) The data transmissions to the PMDT shall be in ASCII and formatted in engineering units.
- (2) The RMS shall provide to the PMDT the following options for displaying information:
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 - (c) A single parameter with current value and threshold values;
 - (d) The value of any selected parameter at nominal 10 second intervals;
 - (e) A list of the Record of Events as defined in 3.2.1.8.3.5;
 - (f) A list of the Historical Performance Record as defined in 3.2.1.8.2.5;
 - (g) Display and print the contents of basic and auxiliary data words;
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3.2.5.1.2 Switching devices.

- (1) Operational switching devices, except as noted in (2), which operate in response to automatic operation shall have a minimum life of 5,000,000 operations.
- (2) High power RF switching devices, power supply circuit breakers and relays, and telephone line switching devices, and all manually operated switching devices, shall have a minimum life of 100,000 operations.

3.2.5.1.3 Not Used.

3.2.5.1.4 Not Used.

3.2.5.1.5 Category II and III equipment.

3.2.5.1.5.1 Category II equipment.

3.2.5.1.5.1.1 Category II continuity of service.

- (1) Azimuth, elevation and DME/P equipment intended for use in Category II operations shall have continuity of service values not less than the values specified in Table 23.
- (2) Continuity of service calculations shall be based on the following:
 - (a) for continuously monitored functions, the time interval in Table 23, and
 - (b) for functions not continuously monitored (e.g. control circuits) the time interval between verification of the proper operation of each function (e.g., end-to-end integrity check interval).

3.2.5.1.5.1.2 Category II integrity.

- (1) The integrity of each Azimuth, Elevation and DME/P equipment intended for use in Category II operations shall be at least $1 - (0.5 \times 10^{-9})$.
- (2) The time interval over which the integrity applies shall be determined from the time between verifications of proper operation of the equipment (end-to-end integrity check and automatic integrity check) for each failure mode in category i or ii in 3.2.5.1.5.3.2.2(4)(a).

3.2.5.1.2 Switching devices.

- (1) Operational switching devices, except as noted in (2), which operate in response to automatic operation shall have a minimum life of 5,000,000 operations.
- (2) High power RF switching devices, power supply circuit breakers and relays, and telephone line switching devices, and all manually operated switching devices, shall have a minimum life of 100,000 operations.

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3.2.5.1.5.1 Category II equipment.

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- (1) Azimuth, elevation and DME/P equipment intended for use in Category II operations shall have continuity of service values not less than the values specified in Table 23.
- (2) Continuity of service calculations shall be based on the following:
 - (a) for continuously monitored functions, the time interval in Table 23, and
 - (b) for functions not continuously monitored (e.g. control circuits) the time interval between verification of the proper operation of each function (e.g., end-to-end integrity check interval).

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- (1) The integrity of each Azimuth, Elevation and DME/P equipment intended for use in Category II operations shall be at least $1 - (0.5 \times 10^{-9})$.
- (2) The time interval over which the integrity applies shall be determined from the time between verifications of proper operation of the equipment (end-to-end integrity check and automatic integrity check) for each failure mode in category i or ii in 3.2.5.1.5.3.2.2(4)(a).

3.2.5.1.5.2 Category III equipment.

3.2.5.1.5.2.1 Category III continuity of service.

- (1) Azimuth, elevation and DME/P equipment with an installed Category III system conversion kit intended for use in Category III operations shall have continuity of service not less than the values specified in Table 24.

Note: The system design goal should be such that the failure of any single component or LRU does not cause an outage.

- (2) Continuity of service calculations shall be based on:
 - (a) for continuously monitored functions, the time interval in Table 24,
 - (b) for functions not continuously monitored (e.g. secondary equipment and control circuits) the time interval between verification of the proper operation of each function (e.g. end-to-end integrity check interval).

3.2.5.1.5.2.2 Category III integrity.

- (1) The integrity of each Azimuth, Elevation and DME/P equipment intended for use in Category III operations shall be at least $1 - (0.5 \times 10^{-9})$.
- (2) The time interval over which the integrity applies shall be determined from the time between verifications of proper operation of the equipment (end-to-end integrity check or automatic integrity check) for each failure mode in category i or ii in 3.2.5.1.5.3.2.2(4)(a).

3.2.5.1.5.3 Requirements common to Category II and III equipment.

3.2.5.1.5.3.1 Calculations of continuity of service. The following factors shall be explicitly accounted for when calculating continuity of service:

- 1) The inherent failure rate of the equipment,
- 2) Outages caused by temporal drift of an integrity parameter,
- 3) Outages caused by false integrity alarms due to causes that are design dependent, and
- 4) The time interval between verification of proper operation of any secondary equipment and control circuits.

TABLE 24 CATEGORY III CONTINUITY OF SERVICE

	Equivalent <u>Continuity of Service</u>	<u>Outages per Million Hours</u>	<u>Time Interval</u>
Category III Azimuth Equipment	1-3.3x10 ⁻⁷	20	60.0 sec
Category III Elevation Equipment	1-8.3x10 ⁻⁸	20	15.0 sec
Category III DME/P Equipment	1-8.3x10 ⁻⁸	20	15.0 sec

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Category III Elevation Equipment	1-8.3x10 ⁻⁸	20	15.0 sec
Category III DME/P Equipment	1-8.3x10 ⁻⁸	20	15.0 sec

- (b) The FMECA shall be carried out to the part level for the executive monitor(s) and all other functions that are critical for achieving the required integrity and continuity of service. Critical functions are all those that have at least one failure mode that falls in categories i, ii, or iii in subparagraph (a) above. It may be limited to the functional level for all other parts of the MLS Ground System. System level functions will be included in the analysis (e.g. System Control, Interstation communication, RMS). All failures that are detected only by end-to-end integrity checks will be so noted.
- (c) For systems with antennas designed to allow for a number of component failures (fail soft), the FMECA shall include an analysis of the effects of multiple failures, with the number equal to the maximum allowed.

3.2.5.2 Maintainability.

3.2.5.2.1 Corrective maintenance.

- (1) The mean time to repair (MTTR) the Azimuth, Elevation, DME/P, RCSU and RSU equipments with installed Category II/III conversion kit shall be 30 minutes or less.
- (2) The maximum time to repair the Azimuth, Elevation, DME/P, RCSU and RSU equipments with installed Category II/III conversion kit shall not exceed 60 minutes for 95 percent of all repairs.

NOTE: Execution time for automatically initiated diagnostics in 3.2.5.2.1.1(1)(b) is not required to be included in MTTR.

3.2.5.2.1.1 The process. System corrective maintenance is described by the following process.

- (1) The system shall incorporate the functional requirements described by this process:
 - (a) Generation of a Hard/Soft Alarm Message by the RMS in response to a fault in the MLS Ground System;
 - (b) Generation of a Diagnostics Result Message by the RMS which localizes the fault to the equipment and identifies the faulty LRU;
 - (c) Removal of the faulty LRU with a serviceable unit;

- (d) Performance of any required alignment, reset, adjustments, tuning, program operations, or data loading operations, using only physical observations, the RMS and support equipment; and
- (e) Performance of system checkout tests using only the Local Control and Status Unit (LCSU) and PMDT, and recertification of the facility via the RMS.

3.2.5.2.2 Bench repair. The mean bench repair time shall be one hour or less, with 95 percent of all repairs accomplished in less than 4 hours.

3.2.5.2.3 Mean preventive maintenance time (MPMT). The MPMT of the Azimuth, Elevation, DME/P, RCSU and RSU equipments with an installed Category III System Conversion Kit shall not exceed 6 hours per 180 days of operation (including calibration of the monitoring system). Visits to sites for PM shall not be required more often than one in 180 days.

3.2.5.3 Availability. Not Applicable.

3.2.5.4 Additional Quality Factors. Not Applicable.

3.2.6 Environmental Conditions.

3.2.6.1 Natural Environment.

3.2.6.1.1 General.

- (1) The REU, RSU panels and RCSU panel shall meet the service conditions of Environment I, (paragraph 3.3.1.5.2 of FAA-G-2100).
- (2) All equipment installed outdoors shall meet the service conditions of Environment III, (paragraph 3.3.1.5.2 of FAA-G-2100), except that the operating temperature range of the environmental conditions shall be -50°C to +50°C.
 - (a) This shall be accomplished without the use of environmental controls (Appendix A), except for fans and heaters.

3.2.6.1.2 Antenna radomes.

3.2.6.1.2.1 Radome deicers.

- (1) All antenna radomes, except for DME/P antenna radomes, shall have deicers which will be automatically activated during periods of ice accumulation and automatically deactivated during periods of non-icing.

- (d) Performance of any required alignment, reset, adjustments, tuning, program operations, or data loading operations, using only physical observations, the RMS and support equipment; and
- (e) Performance of system checkout tests using only the Local Control and Status Unit (LCSU) and PMDT, and recertification of the facility via the RMS.

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3.2.6.1.2 Antenna radomes.

3.2.6.1.2.1 Radome deicers.

- (1) All antenna radomes, except for DME/P antenna radomes, shall have deicers which will be automatically activated during periods of ice accumulation and automatically deactivated during periods of non-icing.

- (4) Because the "frangible break-away mechanisms" are sensitive to impact forces, the seismic evaluation of the frangible structures and Equipment shall be done by the dynamic analysis method.
- (5) The maximum allowable stress for members, connections and the break-away mechanisms which are subjected to repeated variation of live load stresses shall not exceed that given in the Design Specification, Fatigue, Appendix B, Manual of Steel Construction of the AISC. This Limitation is in addition to the reduction which must be made for slender compression members and members with multiple load stresses acting at the same time.

3.2.6.1.5 Wind vibration.

- (1) The structural components of the MLS shall be designed so that no member(s) will vibrate within $\pm 10\%$ of its resonating frequencies induced by the aerodynamics response of the structure to the wind forces.
- (2) The application of the wind loadings criteria shall be in accordance with ANSI A58.1, "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures," of the American National Standards Institute.

3.2.6.2 Induced Environment.

- (1) The equipment shall be designed and constructed to meet all performance requirements specified, when subjected to the following environmental conditions:
 - (a) Solar radiation MIL-STD-810, Method 505.2, Procedure I. Radiant energy from heat lamps may be used to achieve the specified levels of radiant energy.
 - (b) Rain MIL-STD-810, Method 506.2, Procedure I, 4 inches per hour
 - (c) Shock MIL-STD-810, Method 516.3, Procedure II
 - (d) Snow loading 40 psf
 - (e) Ice loading Table III, FAA-G-2100
 - (f) Hail stones 1/2 inch diameter ice

- (4) Because the "frangible break-away mechanisms" are sensitive to impact forces, the seismic evaluation of the frangible structures and Equipment shall be done by the dynamic analysis method.
- (5) The maximum allowable stress for members, connections and the break-away mechanisms which are subjected to repeated variation of live load stresses shall not exceed that given in the Design Specification, Fatigue, Appendix B, Manual of Steel Construction of the AISC. This Limitation is in addition to the reduction which must be made for slender compression members and members with multiple load stresses acting at the same time.

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- (1) The structural components of the MLS shall be designed so that no member(s) will vibrate within $\pm 10\%$ of its resonating frequencies induced by the aerodynamics response of the structure to the wind forces.
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 - (b) Rain MIL-STD-810, Method 506.2, Procedure I, 4 inches per hour
 - (c) Shock MIL-STD-810, Method 516.3, Procedure II
 - (d) Snow loading 40 psf
 - (e) Ice loading Table III, FAA-G-2100
 - (f) Hail stones 1/2 inch diameter ice

3.2.8.2 Category III System Conversion Kit.

- (1) In order to satisfy the Category III equipment configuration requirements of 3.2.8.3, each Category III Conversion Kit shall as a minimum include the following for the azimuth, elevation and DME/P equipments: software (as defined in 3.3.5.2 and 3.3.4.2.1.4), switching, installation instructions, cabling, executive monitors, transmitters, power supplies, amplifiers and Local Control and Status Unit. Exempt from this requirement are all transmitting antennas and associated RF circuitry (i.e., phase shifters and power dividers).
- (2) All Category III System Conversion Kit hardware, with the exception switching circuits, shall be identical in design and construction to hardware in the azimuth, elevation and DME/P equipments.

3.2.8.3 Category III Equipment Configuration.

- (1) The Category III System Conversion Kit, when installed with the azimuth, elevation and DME/P equipments, shall result in a standby configuration (Appendix A) with the following characteristics:
 - (a) The Category III requirements of 3.2.5.1.5.2 shall be met without the provision of standby transmitting antennas. This does not preclude the use of standby or redundant components within the antennas.
 - (b) Either equipment of the standby configuration shall be capable of being operated as primary or secondary equipment (Appendix A).
 - (c) Manual selection of the primary equipment shall be available at the MPS and at the RCSU and LCSU panels.
 - (d) The equipment shall automatically switchover from the primary to the secondary equipment upon detection of an integrity alarm.
 - (e) The period of zero or erroneous guidance information shall be less than one second.
 - (i) This period shall include the time required for detection of an out of tolerance condition, switchover from primary to secondary, and initialization (if any) of the secondary equipment.

3.2.9 Portability. Not applicable.

3.3 DESIGN AND CONSTRUCTION.

3.3.1 Materials.

3.3.1.1 Toxic Products and Formulations. Not Applicable.

3.3.1.2 Dissimilar materials.

- (1) Dissimilar materials that are electrolytically incompatible with the tendency towards galvanic corrosion shall not be placed permanently in contact with each other unless they are suitably protected against galvanic action by suitable quiescent materials.
- (2) Nonmetals in contact with metals shall be considered dissimilar unless there is technical data supporting compatibility. This includes plastics, wood, and concrete.
- (3) The classification for metals which are compatible shall be in accordance with MIL-STD-889.

3.3.1.3 Materials specification. The contractor shall provide for FAA's approval, complete physical and chemical properties of the material/materials selected.

3.3.1.4 Physical transmission media.

- (1) Unless otherwise specified, each interface of the MLS equipment shall be capable of connecting to any one or more of the following types of physical transmission media: wire lines, voice grade special access service lines, fiber optic lines, or radio.
- (2) Unless otherwise specified, all wire and radio interfaces shall be capable of supporting repeaterless communications over distances of at least 3.5 miles.
- (3) Unless otherwise specified, fiber optic interfaces shall be capable of supporting repeaterless communications over distances of at least 6.0 miles.
- (4) All communication equipment and cables associated with these interfaces shall meet the service conditions as specified in 3.2.6.1.1.
- (5) The application of these interfaces to implement a particular communication capability shall be as defined in 3.2.3 and 3.2.2.1.

3.3.1 Materials.

3.3.1.1 Toxic Products and Formulations. Not Applicable.

3.3.1.2 Dissimilar materials.

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- (2) Unless otherwise specified, all wire and radio interfaces shall be capable of supporting repeaterless communications over distances of at least 3.5 miles.
- (3) Unless otherwise specified, fiber optic interfaces shall be capable of supporting repeaterless communications over distances of at least 6.0 miles.
- (4) All communication equipment and cables associated with these interfaces shall meet the service conditions as specified in 3.2.6.1.1.
- (5) The application of these interfaces to implement a particular communication capability shall be as defined in 3.2.3 and 3.2.2.1.

- (3) The physical transmission media between the MLS equipment and the transmitters and receivers shall be either coax cable or wire lines having interface characteristics as specified in 3.3.1.4.1.
- (4) At any particular site, radio communications shall be conducted on a single channel.

3.3.2 Electromagnetic Radiation. Transient protection and grounding requirements shall be as specified in 3.3.6.1 and 3.3.6.2.

3.3.2.1 Electromagnetic compatibility.

- (1) The MLS Ground System shall operate without degradation due to interference from normal airport RF radiation sources and shall be tested for proper operation within the electromagnetic emission and susceptibility limits specified in Parts 1, 3 and 4 of MIL-STD-461 and the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, (see Table 25).
- (2) Additionally, the MLS Ground System shall operate without degradation due to interference from pulse type signals specified in Table 25.
- (3) Pulse signal tests shall not cause an hard/soft alarm after the test signal is removed.
- (4) The electromagnetic emissions and susceptibility requirements of this paragraph shall be met with the walk-in enclosure doors open and all fans and heaters operating.
- (5) The MLS shall also meet the applicable type acceptance criteria of the Federal Communications Commission, and FAA-G-2100, paragraph 3.3.1.1 and 3.3.8.3.
- (6) Each MLS station shall meet the requirements of FAA-STD-022, paragraphs 4.1.4 through 4.1.4.4.

- (3) The physical transmission media between the MLS equipment and the transmitters and receivers shall be either coax cable or wire lines having interface characteristics as specified in 3.3.1.4.1.
- (4) At any particular site, radio communications shall be conducted on a single channel.

3.3.2 Electromagnetic Radiation. Transient protection and grounding requirements shall be as specified in 3.3.6.1 and 3.3.6.2.

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- (1) The MLS Ground System shall operate without degradation due to interference from normal airport RF radiation sources and shall be tested for proper operation within the electromagnetic emission and susceptibility limits specified in Parts 1, 3 and 4 of MIL-STD-461 and the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management, (see Table 25).
- (2) Additionally, the MLS Ground System shall operate without degradation due to interference from pulse type signals specified in Table 25.
- (3) Pulse signal tests shall not cause an hard/soft alarm after the test signal is removed.
- (4) The electromagnetic emissions and susceptibility requirements of this paragraph shall be met with the walk-in enclosure doors open and all fans and heaters operating.
- (5) The MLS shall also meet the applicable type acceptance criteria of the Federal Communications Commission, and FAA-G-2100, paragraph 3.3.1.1 and 3.3.8.3.
- (6) Each MLS station shall meet the requirements of FAA-STD-022, paragraphs 4.1.4 through 4.1.4.4.

TABLE 25 (Continued)

<u>Specification</u>	<u>Test</u>	<u>Test Description</u>	<u>Frequency Limits</u>	<u>Amplitude Limits</u>
MIL-STD-461 Part 3	RS03	E l e c t r i c Field Suscep- tibility (3)	14 KHz-10 GHz	Para. 17 (MIL-STD-461)
NTIA Manual	Para. 5.4.2	F r e q u e n c y Tolerance	Per Manual	-
NTIA Manual	Para. 5.4.2	Spurious Ra- diation	-	Per Manual, Para. 5.1.3I
NTIA Manual	Para. 5.4.2	Bandwidth	Per Manual	-

*Part 4

- Note (1): Test CE03: AC, DC and interconnecting cabling shall meet both the narrowband and broadband requirements of MIL-STD-461 (AF Procurement).
- Note (2): Test CS01: DC power leads shall be monitored during AC tests to determine if any interference in the DC circuit can be detected.
- Note (3): Also pulse tests in Table 26.

TABLE 25 (Continued)

<u>Specification</u>	<u>Test</u>	<u>Test Description</u>	<u>Frequency Limits</u>	<u>Amplitude Limits</u>
MIL-STD-461 Part 3	RS03	E l e c t r i c Field Suscep- tibility (3)	14 KHz-10 GHz	Para. 17 (MIL-STD-461)
NTIA Manual	Para. 5.4.2	F r e q u e n c y Tolerance	Per Manual	-
NTIA Manual	Para. 5.4.2	Spurious Ra- diation	-	Per Manual, Para. 5.1.3I
NTIA Manual	Para. 5.4.2	Bandwidth	Per Manual	-

*Part 4

- Note (1): Test CE03: AC, DC and interconnecting cabling shall meet both the narrowband and broadband requirements of MIL-STD-461 (AF Procurement).
- Note (2): Test CS01: DC power leads shall be monitored during AC tests to determine if any interference in the DC circuit can be detected.
- Note (3): Also pulse tests in Table 26.

3.3.2.2 Cross-talk, shielding and isolation.

- (1) Adequate shielding and other means of isolation shall be provided as necessary to prevent the occurrence of significant changes in signal levels, waveforms, timing, tuning, or operating conditions with any combination of open card rack access doors or withdrawn chassis or with printed circuit board extender in use. The EMC requirements specified in 3.3.2.1 are not required to be met under these operating conditions.
- (2) Also the temporary repositioning of wires or cables which is required to perform corrective maintenance on the equipment shall not affect the operating conditions or performance of the equipment.

3.3.2.3 Microwave Radiation Exposure Limits.

- (1) The MLS design shall be in accordance with Department of Labor Occupational Safety and Health Standards (OSHA), Title 29, Chapter XVII, Part 1910, Subpart G; and ANSI C95.1.
- (2) The radiation shall be measured in accordance with ANSI C95.5.

3.3.3 Nameplates and Product Marking.

3.3.3.1 Data plate.

- (1) A nonferrous metal data plate, approximately 3 inches by 6 inches, shall be provided on the lower exterior surface at the lock side of the exterior opening of each enclosure so as not to be hidden by steps or foundation work.
- (2) The data plate shall contain the following information in the order listed:

Microwave Landing System (Azimuth-DME/P/Elevation) Station

Manufactured by (manufacturer's name) for

FEDERAL AVIATION ADMINISTRATION

FAA Type Number: _____

Contract Number: _____

Serial Number: _____

Curb Weight: _____ pounds

Gross Weight, maximum: _____ pounds

Maximum gross weight is defined as the maximum possible weight of the enclosure and its contents. Curb weight is defined as the enclosure weight with only mechanical and electrical equipment installed.

- (3) The manufacturer's name shall not be visible on the finished shelter except on the data plate.
- (4) Additional name plates shall be provided in accordance with FAA-G-2100, paragraph 3.10.

3.3.3.1.1 Nomenclature (DOD). Those systems to be delivered to the Department of Defense (DOD) shall be type designated in accordance with MIL-N-7513, Nomenclature Assignment, contractors method of obtaining.

3.3.3.1.2 Data plate (DOD). The data plates of those systems that are to be delivered to the Department of Defense shall conform to MIL-STD-130, Identification Marking of U.S. Military Property.

3.3.3.2 Product Marking. The equipment and all parts shall be marked in accordance with FAA-G-2100, sections 3.8 and 3.9.

3.3.4 Workmanship.

3.3.4.1 General Equipment Requirements.

- (1) General design and construction of MLS Ground System shall be in accordance with FAA-G-2100; paragraphs 3.3.1 and 3.3.3, section 3.7; and MIL-STD-454 as specified in the following subparagraphs and the maintenance concept of 3.2.5 through 3.2.5.2.4.
- (2) The equipment shall meet the performance requirements of FAA-G-2100, paragraph 3.3.4.
- (3) Part selection shall be in accordance with FAA-G-2100, section 3.5
- (4) Material selection shall be in accordance with FAA-G-2100, section 3.6.

3.3.4.1.1 Modular construction.

- (1) The MLS shall be designed such that failed components are easily replaced by plug-in modules.
- (2) Modularization shall be based on logical functional block concepts.

3.3.4.1.1.1 Printed wiring boards.

- (1) All printed wiring boards shall be in accordance with FAA-G-2100, section 3.4.

- (3) The manufacturer's name shall not be visible on the finished shelter except on the data plate.
- (4) Additional name plates shall be provided in accordance with FAA-G-2100, paragraph 3.10.

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- (2) The equipment shall meet the performance requirements of FAA-G-2100, paragraph 3.3.4.
- (3) Part selection shall be in accordance with FAA-G-2100, section 3.5
- (4) Material selection shall be in accordance with FAA-G-2100, section 3.6.

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- (1) The MLS shall be designed such that failed components are easily replaced by plug-in modules.
- (2) Modularization shall be based on logical functional block concepts.

3.3.4.1.1.1 Printed wiring boards.

- (1) All printed wiring boards shall be in accordance with FAA-G-2100, section 3.4.

3.3.4.1.6 Test provisions. Test provisions shall be in accordance with the appropriate provisions of MIL-STD-454, Requirement 32.

3.3.4.1.7 Panel controls.

- (1) The MLS Ground System shall provide controls that are essential to the proper operation or maintenance of the equipment and have scale markings to facilitate return of the control to a pre-determined position.
- (2) All controls critical to proper equipment function shall include locking devices.
- (3) Operation of the lock shall not disturb the setting of the control.
- (4) All controls shall be clearly marked as to function, maintenance data reference symbol and normal range of operation.
- (5) All controls shall be accessible on the front of each equipment unit or shall be immediately available from the top of the unit upon withdrawing the sliding chassis.

3.3.4.1.8 Real Time Clock.

- (1) The MLS shall provide a real time clock with a resolution of one second.
- (2) Suitable controls shall be provided to set the clock.
- (3) The clock shall accumulate an error not greater than 6 seconds in 1 year.
- (4) The output of this clock shall be used in time stamping RMS events as defined in 3.2.1.8.3.6.

3.3.4.2 Software development. All MLS system software and firmware shall be developed in accordance with DOD-STD-2167.

3.3.4.2.1 Programming Requirement.

3.3.4.2.1.1 Programming Language. All MLS software shall be written in Ada, as defined by MIL-STD-1815.

3.3.4.2.1.2 Compilers and Assemblers.

- (1) All compilers shall be off-the-shelf, vendor-supported and compliant with current Ada Compiler Validation Capability (ACVC) validation test suite.

- (2) In addition, the compiler and any software associated with the transformation of source code from text into executable form shall also comply with the requirements of paragraph 4.5 of DOD-STD-2167.

3.3.4.2.1.3 Operating System. All operating system software shall be off-the-shelf, vendor-supported.

3.3.4.2.1.3.1 Operating System Augmentation. Operating system augmentations shall be allowed, provided they are treated as newly developed software and do not compromise the capability of the operating system vendor to provide maintenance and updates.

3.3.4.2.1.4 Design and Coding Constraints.

- (1) There shall be a single system software development which results in a single set of software which completely supports MLS performance requirements under all equipment types (Table 6) and both Category II and III configurations.
- (2) Newly developed support software will be allowed except for compilers, assemblers, debuggers, linking loaders, and editors which shall be off-the-shelf, vendor supported.
- (3) Software and firmware code shall be designed to preclude self-modification.
- (4) Software shall be modular to the greatest extent consistent with program efficiency.

3.3.4.3 Physical structures.

3.3.4.3.1 Antenna support material and design.

- (1) The materials and configurations shall be as indicated in the antenna requirements set forth in the contract and the contractor's site engineering report as specified in 5-1-3.5.4 and 5-2-3.5 of FAA-E-2721/15.
- (2) Except for the concrete foundations, the materials selected for structural supports, mechanical equipment, platforms, towers and buildings shall be suited for the configurations selected for the structure/equipment etc. Materials which can be used are not limited provided all other requirements of this specification are met.
- (3) The materials selected for Azimuth and Elevation Stations shall be in accordance with paragraph 3.8 of FAA-ER-530-81-04.

- (2) In addition, the compiler and any software associated with the transformation of source code from text into executable form shall also comply with the requirements of paragraph 4.5 of DOD-STD-2167.

3.3.4.2.1.3 Operating System. All operating system software shall be off-the-shelf, vendor-supported.

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- (2) Except for the concrete foundations, the materials selected for structural supports, mechanical equipment, platforms, towers and buildings shall be suited for the configurations selected for the structure/equipment etc. Materials which can be used are not limited provided all other requirements of this specification are met.
- (3) The materials selected for Azimuth and Elevation Stations shall be in accordance with paragraph 3.8 of FAA-ER-530-81-04.

- (15) Joints of structures of equipment components made of steel and connected by the electric or gas arc welding processes shall be designed and welded in accordance with the AWS D1.1, American Welding Society Structural Welding Code.

3.3.4.3.1.1 Life cycle. The MLS structures (towers/buildings, etc.) shall be capable of withstanding the outdoor environmental weather conditions as stipulated in 3.2.6.2 without damage or degradation of operations during a 20 year life expectancy.

3.3.4.3.1.2 Foundations and concrete structures.

- (1) All concrete structures/components shall be a minimum 3000 pounds per square inch concrete of portland cement, fine and coarse aggregate and air entertainment agent in accordance with Standard ACI-318 and chapters 1 thru 6, 8, 12 and 17 of ACI-301.
- (2) Forms shall be used for all concrete foundation construction (4.1.3 of ACI-301).
- (3) The concrete shall have a maximum slump of 3 inches.
- (4) Concrete reinforcement shall be deformed reinforcement steel conforming to ASTM A615 or equal.
- (5) Construction of all concrete work shall conform to Part 3 of ACI-318 and applicable chapters of ACI-301.
- (6) The bottom of all foundations shall be carried a minimum depth of 12 inches below the local frost depth unless other approved methods are used to prevent frost heave of the foundations, such as pile foundations.
- (7) Excavation deeper than the required depth shall be brought to the correct level with plain concrete, which shall be allowed to harden before the foundation concrete is placed.
- (8) All foundation designs shall be adapted by the Contractor as necessary to meet local soil conditions and the reactions resulting from the maximum dead and live loads the antenna must sustain.
- (9) The top of the foundation shall be no higher than 1-1/2 inches above the top elevation of the ground in the immediate area of the structure.
- (10) The top four edges of the foundation piers, pedestals, etc., which are above ground, shall be chamfered a minimum of one inch for the entire width of each face.

- (11) Except when local site conditions dictate other suitable types of foundation, the standard reinforced concrete foundation for both elevated and ground mounted structures shall be of the spread footing type design.
- (12) In addition, all piers and pedestals of an elevated structure shall be anchored in a single spread footing to prevent differential settlement, heaving, or uplift associated with high wind loads.
- (13) The foundation design shall be based on ACI publication title No. 336-2 of committee 436.
- (14) The foundation design shall be considered rigid based on the relative stiffness ratio method as evaluated by ACI 336.2.
- (15) If required for stiffness the pedestals shall be tied together with horizontal reinforced concrete grade beams or shear walls.
- (16) For sites located in major earthquake areas the foundation pedestals shall be connected with the horizontal grade beams or shear walls.
- (17) Supports and foundations stability requirements shall be based on the accuracy stipulated in paragraph 3.5 of FAA-STD-022, 3.2.1.1.14.1.3 and 3.2.1.2.13.1.3.
- (18) The design of the spread footing foundation and/or the solid bulk type foundation shall be based on the following safe loads:
 - (a) Safe bearing pressure = ultimate soil bearing strength/2.0;
 - (b) Safe shear force = Ultimate soil shear strength/2.0; and
 - (c) The stability against overturning forces, including hydrostatic pressure, is based on a safety factor against overturning of 3.0.
- (19) Base plates shall be used under tower columns etc., for distribution of the compressive loads over a sufficient area of the concrete support pier or pedestal.
 - (a) The top of the pedestal or pier shall be left approximately 2 inches lower than the finished grade in order to allow for the proper alignment of the columns, etc.
 - (b) Non-shrink grout shall be used to grout in the bases of the columns and other structures supported directly by the concrete foundation.

- (11) Except when local site conditions dictate other suitable types of foundation, the standard reinforced concrete foundation for both elevated and ground mounted structures shall be of the spread footing type design.
- (12) In addition, all piers and pedestals of an elevated structure shall be anchored in a single spread footing to prevent differential settlement, heaving, or uplift associated with high wind loads.
- (13) The foundation design shall be based on ACI publication title No. 336-2 of committee 436.
- (14) The foundation design shall be considered rigid based on the relative stiffness ratio method as evaluated by ACI 336.2.
- (15) If required for stiffness the pedestals shall be tied together with horizontal reinforced concrete grade beams or shear walls.
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- (17) Supports and foundations stability requirements shall be based on the accuracy stipulated in paragraph 3.5 of FAA-STD-022, 3.2.1.1.14.1.3 and 3.2.1.2.13.1.3.
- (18) The design of the spread footing foundation and/or the solid bulk type foundation shall be based on the following safe loads:
 - (a) Safe bearing pressure = ultimate soil bearing strength/2.0;
 - (b) Safe shear force = Ultimate soil shear strength/2.0; and
 - (c) The stability against overturning forces, including hydrostatic pressure, is based on a safety factor against overturning of 3.0.
- (19) Base plates shall be used under tower columns etc., for distribution of the compressive loads over a sufficient area of the concrete support pier or pedestal.
 - (a) The top of the pedestal or pier shall be left approximately 2 inches lower than the finished grade in order to allow for the proper alignment of the columns, etc.
 - (b) Non-shrink grout shall be used to grout in the bases of the columns and other structures supported directly by the concrete foundation.

- (6) The environmental requirements of 3.2.6.2 shall be met when the enclosure is in a closed, secured, and operational position.
- (7) The enclosure shall utilize a door which will function in the environment specified in 3.2.6.2 with a minimum opening to allow entry of a maintenance technician with the largest replaceable unit or support equipment.
- (8) The enclosure material shall be lightweight aluminum alloy or thermoset epoxy resin reinforced plastic treated for fire retardancy and weather resistance, and meet the frangibility requirements of 3.3.6.4.
- (9) The design of the azimuth enclosure shall be symmetrical about the azimuth antenna phase center so as to minimize the diffraction/blockage effects on the ILS localizer signals when the azimuth is sited ahead of the ILS localizer antenna on the extended runway centerline.
- (10) The walk-in equipment enclosure shall contain an adjustable thermostat controlled exhaust fan (for personnel use) and a work table for placing the PMDT or other test equipment.
- (11) The enclosure shall contain lighting in accordance with MIL-STD-1472, 5.8.2, Table XXI, for nighttime maintenance by the technician, including a battery (float charged) backed emergency light in the event facility power is lost.
- (12) Each equipment enclosure shall be furnished with an intrusion detector.
- (13) The intrusion detector shall provide notification to the RMS when an enclosure door is opened.
- (14) Each equipment enclosure shall be furnished with an ionization type smoke detector.
- (15) The smoke detector shall provide notification to the RMS when products of combustion are sensed.

3.3.4.4 Processes. All processes used during assembly and construction shall be in accordance with FAA-G-2100, section 3.7.

3.3.5 Interchangeability.

3.3.5.1 Hardware interchangeability. Interchangeability shall be in accordance with FAA-G-2100, paragraph 3.5.4.

3.3.5.2 Software interchangeability.

The software shall be adapted to individual sites by programming the appropriate site specific parameter values (Appendix A) in firmware.

3.3.6 Safety.

3.3.6.1 Transient protection. The MLS Ground System shall be designed, fabricated, and tested to meet the requirements of FAA-STD-019 and FAA-STD-020.

3.3.6.2 Grounding requirements.

- (1) The grounding systems for the MLS Ground System shall be designed and installed in accordance with requirements of the NFPA 70, FAA-STD-019, and FAA-STD-020. The specific requirements include but are not limited to the following:
 - (a) The earth electrodes shall be in accordance with 3.10 of FAA-STD-019 and the related subparagraphs.
 - (b) The electronic equipment frame grounding shall be in accordance with 3.11 of FAA-STD-019 and the related subparagraphs.
 - (c) The signal reference shall be in accordance with 3.12 of FAA-STD-019 and the related subparagraphs.
 - (d) The AC power shall be grounded in accordance with 3.13 of FAA-STD-019 and the related subparagraphs.

3.3.6.3 Obstruction lights.

- (1) Dual obstruction lights shall be provided per FAA Advisory Circular 150/5345-1 and installed per Advisory Circular 70/7460-1. Obstruction lights will be selected from the list in FAA Advisory Circular 150/5345-1.
- (2) The lamps in each fixture shall be photoelectrically controlled and shall be wired in parallel.
- (3) Obstruction lights shall be installed above the Approach Azimuth, Back Azimuth, Approach Elevation, DME/P antennas, and field monitors.
- (4) The field monitors shall be designed such that the obstruction lights are easily removable. The lights may not be required when the field monitor is less than 150 feet away from and is lower in height than the transmitting antenna.

3.3.6 Safety.

3.3.6.1 Transient protection. The MLS Ground System shall be designed, fabricated, and tested to meet the requirements of FAA-STD-019 and FAA-STD-020.

3.3.6.2 Grounding requirements.

- (1) The grounding systems for the MLS Ground System shall be designed and installed in accordance with requirements of the NFPA 70, FAA-STD-019, and FAA-STD-020. The specific requirements include but are not limited to the following:
 - (a) The earth electrodes shall be in accordance with 3.10 of FAA-STD-019 and the related subparagraphs.
 - (b) The electronic equipment frame grounding shall be in accordance with 3.11 of FAA-STD-019 and the related subparagraphs.
 - (c) The signal reference shall be in accordance with 3.12 of FAA-STD-019 and the related subparagraphs.
 - (d) The AC power shall be grounded in accordance with 3.13 of FAA-STD-019 and the related subparagraphs.

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- (3) Obstruction lights shall be installed above the Approach Azimuth, Back Azimuth, Approach Elevation, DME/P antennas, and field monitors.
- (4) The field monitors shall be designed such that the obstruction lights are easily removable. The lights may not be required when the field monitor is less than 150 feet away from and is lower in height than the transmitting antenna.

3.3.6.6 Lightning Protection. Protection from lightning shall be designed, fabricated, and tested to meet the requirements of FAA-STD-019 and FAA-STD-020.

3.3.7 Human Engineering.

- (1) All facilities and facility equipment shall conform with applicable requirements of MIL-STD-1472 (Applicable sections of the standard are 5.6, 5.7, and 5.9.) and FAA-G-2100, paragraph 3.3.1.3.
- (2) Equipment layout shall provide clear and unrestricted access to any rack or equipment unit.
- (3) All panel displays shall be readable in light levels from bright sunlight, artificial light, to near darkness, at a distance of 10 feet, and at a horizontal viewing angle of 30° either side and a vertical viewing angle to 20° either side from the perpendicular to the plane of the display.

3.3.8 Nuclear Control. Not Applicable.

3.3.9 System Security.

3.3.9.1 Physical Security. All equipment not housed in a secured building or structure shall be provided with a method of being physically secured to prevent tampering, vandalism, and access by other than authorized personnel.

3.3.9.2 PMDT Security.

- (1) The RMS shall use passwords and user identifiers to prevent log-on of unauthorized personnel.
- (2) The MPS is a secure system and password access to the MLS RMS shall not be required.

3.3.9.2.1 Passwords and user identifiers.

- (1) A password consisting of five alphanumeric characters and a user identifier (UID) consisting of three alphanumeric characters shall be required to gain access to the RMS.
- (2) Each successful log-on shall be reported to the MPS.
- (3) After three consecutive unsuccessful log-ons the interface shall be disabled for fifteen minutes and the event reported to the MPS as a state change.
- (4) At least 24 unique password and user identifiers shall be provided.

3.3.6.6 Lightning Protection. Protection from lightning shall be designed, fabricated, and tested to meet the requirements of FAA-STD-019 and FAA-STD-020.

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- (1) All facilities and facility equipment shall conform with applicable requirements of MIL-STD-1472 (Applicable sections of the standard are 5.6, 5.7, and 5.9.) and FAA-G-2100, paragraph 3.3.1.3.
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- (3) After three consecutive unsuccessful log-ons the interface shall be disabled for fifteen minutes and the event reported to the MPS as a state change.
- (4) At least 24 unique password and user identifiers shall be provided.

3.3.11 Computer Resource Reserve Capacity.

a. MLS Processing Resources.

- (1) MLS processing resource requirements shall be completed by the Contractor in accordance with DOD-STD-2167 and subject to Government approval.
- (2) All MLS system functions shall be addressed both individually and collectively in determining the requirements.

b. Computer Hardware Requirements.

- (1) Worst case loading for each of the following computer resources shall be submitted by the contractor at Critical Design Review (CDR).
- (2) Worst case computer resources loadings shall be subject to government approval.

3.3.11.1 Memory.

3.3.11.1.1 Memory utilization. Under worst case loading conditions, no more than 66 percent of the total addressable, populated memory locations of each type of memory (random access memory, programmable read only memory, electrically programmable read only memory, non-volatile random access memory, programmable logic devices and arrays, and electrically programmable logic devices) associated with embedded processors shall be used during execution of any program to hold instructions or data. For example, if an embedded processor has 8k bytes of ROM's associated with it, no more than 5407 bytes of the available 8192 bytes shall be used. The intent of this requirement is to provide expansion capability to accommodate growth in program size and data storage requirements.

3.3.11.1.2 Memory Growth.

- (1) It shall be possible to increase the amount each type of memory, as identified and approved in 3.3.11.1.1, (random access memory, read only memory, programmable read only memory, electrically programmable read only memory, non-volatile random access memory, programmable logic devices and arrays, and electrically programmable logic devices) associated with each embedded processor by 100 percent. For example, if 8192 bytes of ROM are initially associated with a particular embedded processor, it shall be possible to increase the amount of ROM associated with that processor to 16,384 bytes. The intent of this requirement is to provide for memory expansion capacity beyond that provided by 3.3.11.1.1(1).

- (2) The contractor shall submit proof of compliance with the 100% growth capability prior to being permitted to begin First Article Test. The requirement for growth capability may be satisfied by the contractor, with the approval and at option of the government, by providing fully tested unpopulated sockets along with all the control signals, data storage and retrieval capabilities appropriate for the type of memory, address decoding capabilities, and any other functions needed to fully implement the memory growth performed by plugging in the required number of specified memory integrated circuits.
- (3) All MLS System RAM memory shall incorporate error sensing, error and memory status capable of being read by the associated embedded processor, and an ancillary amount of memory locations implemented as a memory error correction capability.
- (4) MLS system memory associated with each and every embedded microprocessor shall be equipped with switches or jumpers enabling contiguous banks of memory to be made available incrementally and monotonically to the associated embedded processor needing growth potential to satisfy memory utilization requirements.

3.3.11.2 Processing speed.

- (1) Each and every MLS system embedded processor that executes coded instructions in support of MLS system performance requirements, shall use no more than 66% of the processor's instruction set execution capability under worst case loading conditions.
- (2) When each and every MLS system embedded processor is executing coded instructions that are not directly required to support MLS system performance requirements it shall be declared idle.
- (3) The contractor shall propose the minimum intervals of time in which the processor is not executing coded instructions directly in support of MLS system performance functions and can be declared in the idle state at Preliminary Design Review (PDR).
- (4) The minimum intervals shall be subject to government approval.
- (5) During processor idle time periods, the processor shall perform at a minimum, a set of memory, processor and peripheral performance checks.
- (6) These memory, processor and peripheral performance checks shall be counted in the worst case loading conditions used in the 66% maximum processor instruction set execution capability utilization requirements above.

- (2) The contractor shall submit proof of compliance with the 100% growth capability prior to being permitted to begin First Article Test. The requirement for growth capability may be satisfied by the contractor, with the approval and at option of the government, by providing fully tested unpopulated sockets along with all the control signals, data storage and retrieval capabilities appropriate for the type of memory, address decoding capabilities, and any other functions needed to fully implement the memory growth performed by plugging in the required number of specified memory integrated circuits.
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- (5) During processor idle time periods, the processor shall perform at a minimum, a set of memory, processor and peripheral performance checks.
- (6) These memory, processor and peripheral performance checks shall be counted in the worst case loading conditions used in the 66% maximum processor instruction set execution capability utilization requirements above.

3.4.2 Drawings. Drawings shall be prepared and submitted for approval as specified in the CDRL.

3.4.3 Instruction books.

- (1) Manuscript copies of the instruction manuals/books as specified herein, shall be prepared in accordance with the of FAA-D-2494 and the CDRL.
- (2) An instruction book at the system level shall be prepared to tie together all operations and maintenance activities. It will describe the system and its operation as well as the functions and operations of the MLS station. It will also discuss the MLS signal format, the monitoring system concepts and equipment, software/firmware functions and operation, and the relationship to other instruction books and manuals.
- (3) Individual instruction books, in accordance with the above specification, shall also be provided for each station (azimuth and elevation), which will include the description and operation of the mechanical and electrical systems for each station. Each station instruction book will also include the description of all interfaces between stations, and the interfaces between the stations and the remote equipment.
- (4) Individual equipment instruction books shall also be provided for the RCSU, RSU, Portable MLS Receiver (PMR), MLS Module Trouble-shooting and Repair, and Special Test Equipment.
- (5) A separate MLS Module Troubleshooting and Repair manual set shall include instructions for testing the modules on the Automatic Test Equipment (ATE), (over and above the procedures in the ATE instruction book), instruction on use of interface adapters for non-digital modules, part layout drawings, logic diagrams, schematics, contents of diskettes, ATE adapter schematics and parts lists, and bench test adapters schematics and parts lists.
- (6) Section 10 of the technical instruction books shall include an overall summary of the operating software, not complete listings.

3.5 NATIONAL AIRSPACE INTEGRATED LOGISTICS SUPPORT (NAILS).

- (1) Logistics support for the MLS Ground System shall conform to the requirements of MIL-STD-1388-1 and MIL-STD-1388-2. This section sets forth the system requirements or logistics support in the area of maintenance, supply, facilities and facility equipment, personnel, and training.

- (2) An integrated logistics support approach shall be used to evaluate the impact of design alternatives on the cost of ownership, determine a cost-effective maintenance plan for equipment which can be removed and replaced to restore the system to an operational condition, and assist in planning, developing, and implementing a support system for the Microwave Landing System (MLS).
- (3) A Logistics Support Analysis (LSA) shall be performed in concert with the design to guide or constrain design as necessary to assure system supportability.
- (4) A Repair Level Analysis (RLA) of the maintenance requirements shall be performed to determine the most cost effective maintenance level of repair of each defective item.

3.5.1 Maintenance. Maintenance of the MLS Ground System will comply with FAA Order 6000.30.

3.5.1.1 Maintenance planning.

- (1) Maintenance planning shall be based on removal and replacement of faulty Line Replaceable Units (LRUs) at the site.
- (2) Defective LRUs, designated repairable, shall be returned to a depot level maintenance activity for repair.

3.5.1.1.1 On-site. On-site maintenance shall be characterized by replacement of unserviceable LRUs. On-site maintenance also includes routine preventive maintenance (PM) and certification actions as required to maintain a field facility or system in a fully operational status. A maintenance technician will be dispatched to repair the equipment and perform any other maintenance actions, such as PM, that may be required.

3.5.1.1.2 Spare LRUs. All spare LRUs shall meet the requirements of this specification and FAA-STD-022 as applicable.

3.5.1.1.3 Depot Maintenance. The Government will manage the repair, alignment, and calibration of complex equipment, LRUs requiring specialized test and equipment. Rebuild and major modifications will be accomplished at the depot or by a contractor at his plant, or at the facility by mobile teams from the depot or contractor or other commercial source where cost effective.

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- (6) The type of special test equipment shall include, but not be restricted to, a portable MLS receiver.
- (7) The following are the characteristics of the portable MLS receiver (PMR).
 - (a) The PMR shall be capable of receiving, processing and decoding MLS ground system transmissions when the ground equipment is in "Normal Mode" or "Test Mode" as specified in 3.2.1.6.3.2 on any of the 200 assigned MLS frequencies. This capability will be activated through a switch on the front panel control.
 - (b) The PMR shall provide an alphanumeric display.
 - (i) Data to be displayed shall include the following: PFE, CMN, raw angle, all basic data words, all auxiliary data words, fly-left and fly-right clearance, receiver track mode valid or invalid, number of valid decodes of each angle function per second, number of valid decodes of each data word per minute.
 - (ii) All displays shall be clearly visible in bright sunlight and total darkness.

Note 1. Raw angle is defined as the output of the receiver smoothing filter (typically passband of 10 radians per second).

Note 2. Criteria for a valid receiver track mode are contained in RTCA/DO-177.

- (c) The PMR shall provide video outputs designed to connect to an oscilloscope and a video cassette recorder.
- (d) The PMR shall provide a data output conforming to ARINC 429.
 - (i) Data to be output shall include the following: raw angle, all basic data words, all auxiliary data words.
 - (ii) The interface for this output shall meet IEEE 488.
- (e) The PMR shall include an internal rechargeable battery.
- (f) The PMR shall include the capability to operate from a 11-16 V DC vehicle electrical system.

- (g) The PMR shall provide a battery charging system that properly discharges and recharges the internal battery (batteries) to eliminate premature battery failure, protect memory and prevent overcharging.
 - (i) The portable MLS receiver shall be capable of performing its specified functions while the batteries are being recharged.
 - (ii) Continuous operation from the internal battery shall be 45 minutes minimum under all service conditions and 90 minutes minimum at 20°C.
 - (iii) An operational mode shall be selectable which automatically removes battery power after 5 minutes to conserve battery life.
- (h) The PMR shall provide a data output conforming to EIA-232.
 - (i) Data to be available at this output shall be all data provided under item 7b above.
- (i) The PMR shall be capable of operating accurately without interference from existing Instrument Landing Systems (ILS), communication, Low-Level Wind Shear Alert System (LLWAS), weather radar, Airport Surveillance Radar (ASR), and other normal airport radio frequency (RF) radiation sources.
- (j) The PMR shall be capable of evaluating input signals from field monitors and all MLS RF signals (including OCI).
- (k) The PMR shall be packaged for suitcase type carrying.
 - (i) The PMR shall withstand the shock without component failure (MIL-STD-810, Method 516.3, Procedure IV).
- (l) The PMR shall weigh not more than 40 pounds including batteries, accessories, and carrying case, but excluding portable mast.
- (m) The PMR shall provide a portable mast that is light weight, easily transported, and can be erected and assembled easily by one person.
 - (i) The antenna shall be capable of being placed at vertical heights ranging from 5 to 25 feet.
 - (ii) The antenna shall be adjustable in increments of no greater than one foot.

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- (l) The PMR shall weigh not more than 40 pounds including batteries, accessories, and carrying case, but excluding portable mast.
- (m) The PMR shall provide a portable mast that is light weight, easily transported, and can be erected and assembled easily by one person.
 - (i) The antenna shall be capable of being placed at vertical heights ranging from 5 to 25 feet.
 - (ii) The antenna shall be adjustable in increments of no greater than one foot.

- (3) The design of the adapters shall be such that, when used with Contractor provided instructions, the requirements of 3.2.5.2.2 shall be met.

3.5.1.3.3 Special tools. Any special tools required shall be in accordance with the appropriate provisions of MIL-STD-454, Requirement 63.

3.5.2 Supply System Requirements. Supply support shall be in accordance with the Contract.

3.6 PERSONNEL AND TRAINING.

3.6.1 Personnel. The Government will provide and select the technicians to perform maintenance on the MLS. Technicians to be selected will be provided from typical field locations.

3.6.2 Training. The contractor shall develop and conduct required training in accordance with contract requirements.

3.7 CHARACTERISTICS OF SUBORDINATE ELEMENTS. Not Applicable

3.8 PRECEDENCE. In the event of a conflict between the requirements contained in this specification and the various referenced documents, the following precedence shall apply:

FAA-STD-022

This Specification

FAA Standards and Specifications

FAA Orders

Military Standards and Specifications

Federal Standards and Specifications

Other Documents

3.9 QUALIFICATION. Not Applicable

3.10 STANDARD SAMPLE. Not Applicable

3.11 PREPRODUCTION SAMPLE, PERIODIC PRODUCTION SAMPLE, PILOT OR PILOT LOT. Not Applicable

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This Specification

FAA Standards and Specifications

FAA Orders

Military Standards and Specifications

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Other Documents

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3.10 STANDARD SAMPLE. Not Applicable

3.11 PREPRODUCTION SAMPLE, PERIODIC PRODUCTION SAMPLE, PILOT OR PILOT LOT. Not Applicable

4.2.1.1.2.1 Reliability growth tests (RGT).

- (1) A RGT shall be conducted in accordance with MIL-STD-781, MIL-HDBK-781 and Task 302 of MIL-STD-785. The RGT is intended to identify, analyze and correct all design deficiencies and to preclude their recurrence.
- (2) The tests shall culminate with a complete, thorough inspection for fault and/or failure of all articles.
 - (a) The total operating time for the RGT shall be at least 20,000 hours.
 - (b) No modifications shall be made to the equipment during the last 2,500 hours of the test.
- (3) At the end of each 5,000 operating hours of test, the contractor shall provide the test data to the government and make recommendations for test continuation or termination to the government for approval.
- (4) The equipment shall be judged to have satisfactorily completed the RGT when the total operating time has been completed and upon government approval of corrective actions on all faults occurring during testing.
 - (a) Testing shall continue until approved corrective actions have resolved all failures to the satisfaction of the government.
- (5) All faults shall be reported to the government.
 - (a) All faults shall be analyzed to determine the cause of the fault.
 - (b) As a minimum; test time, environmental conditions and equipment configuration data shall be logged at the time of each failure.
- (6) Corrective actions shall be developed for all faults to prevent recurrence.
 - (a) Necessary modifications shall be incorporated into all equipment under test for the purpose of corrective action verification. At the option of the government, the corrective action verification may be accomplished by testing at a lower level of assembly or at the piece part level.

- (7) Although there are no pass/fail criteria, the contractor shall track the reliability growth process to ensure improvement is taking place by effective implementation of the corrective actions.
- (8) Spare LRUs, which are representative of production units in materials, configuration and workmanship, shall be used to permit continued testing during failure investigation.

4.2.1.1.2.2 Reliability demonstration test (RDT).

- (1) Upon the successful completion of the RGT and the incorporation of any design changes evolving from the RGT, the contractor shall demonstrate that the reliability requirements of the azimuth, elevation and DME/P have been achieved by conducting a controlled reliability test in accordance with MIL-STD-781 and MIL-HDBK-781 test plan VI-D.
 - (a) The lower test MTBCF θ , shall be equal to 3333 hours.
 - (b) Failures will be classified in accordance with MIL-STD-781. Relevant failures will be tracked separately for the azimuth, elevation and DME/P. All failures classified as critical shall be used to determine the accept/reject decision.
 - (c) The accept/reject decision shall be based on Figure 14 in MIL-HDBK-781.
- (2) Upon completion of the test stated in item (1), the test shall also be rejected if:
 - (a) The calculated MTBF (total RDT test time divided by total number of relevant failures) lower 90% confidence limit (for an 80% confidence interval, Table 14, MIL-HDBK-781) is less than 2,500 hours for the azimuth, elevation or DME/P equipment; or
 - (b) One relevant failure occurs in the RCSU; or
 - (c) One relevant failure occurs in the RSU.

4.2.1.1.2.3 Configuration control.

- (1) Configuration control shall be established and maintained during reliability testing. Configuration changes during reliability testing are allowed with Government approval so long as the basic objective of demonstrating the reliability of the production equipment is achieved.

- (7) Although there are no pass/fail criteria, the contractor shall track the reliability growth process to ensure improvement is taking place by effective implementation of the corrective actions.
- (8) Spare LRUs, which are representative of production units in materials, configuration and workmanship, shall be used to permit continued testing during failure investigation.

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 - (b) One relevant failure occurs in the RCSU; or
 - (c) One relevant failure occurs in the RSU.

4.2.1.1.2.3 Configuration control.

- (1) Configuration control shall be established and maintained during reliability testing. Configuration changes during reliability testing are allowed with Government approval so long as the basic objective of demonstrating the reliability of the production equipment is achieved.

- (i) Cycle duration shall be 720 hours.
 - (ii) Temperature rate of change shall be no more than 1°C/minute.
 - (iii) Cold soak temperature shall be -50°C for a two (2) hour duration.
 - (iv) Hot soak temperature shall be +50°C for a two hour duration.
- (3) Only preventive maintenance procedures specified for the equipment during service use and listed in the approved test procedure shall be performed during the reliability test.
- (4) During the test, the equipment shall be operated as a normal installation.
- (a) Equipment shall be periodically required to perform ground checks, certification tests, fault diagnostics, and other proof tests at the same frequency as planned for the actual field installed equipment.
- (5) The in-plant RGT shall be for a minimum of 15,000 hours.

4.2.1.1.2.5.2 Field testing.

- (1) The equipment shall be installed and operated as specified in FAA-E-2721/15.
- (2) Test instrumentation and facilities shall be in accordance with MIL-STD-781.
- (3) During the test, the equipment shall be operated as a normal installation.
 - (a) Equipment shall be periodically required to perform ground checks, certification tests, fault diagnostics and other proof tests as required by field service conditions.
- (4) Only preventive maintenance procedures specified for the equipment during service use and listed in the approved test procedure shall be performed during the reliability test.
- (5) The RGT shall continue in the field, if the 20,000 hour requirement, 4.2.1.1.2.1(2)(a), has not been achieved during in-plant testing.
- (6) The RDT shall begin 30 days after completion of the RGT.

- (i) Cycle duration shall be 720 hours.
 - (ii) Temperature rate of change shall be no more than 1°C/minute.
 - (iii) Cold soak temperature shall be -50°C for a two (2) hour duration.
 - (iv) Hot soak temperature shall be +50°C for a two hour duration.
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- (1) The equipment shall be installed and operated as specified in FAA-E-2721/15.
- (2) Test instrumentation and facilities shall be in accordance with MIL-STD-781.
- (3) During the test, the equipment shall be operated as a normal installation.
 - (a) Equipment shall be periodically required to perform ground checks, certification tests, fault diagnostics and other proof tests as required by field service conditions.
- (4) Only preventive maintenance procedures specified for the equipment during service use and listed in the approved test procedure shall be performed during the reliability test.
- (5) The RGT shall continue in the field, if the 20,000 hour requirement, 4.2.1.1.2.1(2)(a), has not been achieved during in-plant testing.
- (6) The RDT shall begin 30 days after completion of the RGT.

4.2.1.1.3 Maintainability demonstration.

- (1) The contractor shall conduct the maintainability demonstration in accordance with the approved maintainability demonstration plan.
- (2) Specific demonstration shall be conducted for each of the following parameters:
 - (a) To establish the mean time to repair (as defined in 3.2.5.2.1) any equipment and
 - (b) the maximum time to repair any equipment.
- (3) Repair shall consist of the process described in 3.2.5.2.1.1.
- (4) MIL-STD-471 shall be used for testing the mean and maximum time respectively.
 - (a) To verify the mean and 95th percentile bench repair times: MIL-STD-471, test method 8, plan A-1 and plan B-2 shall be used for testing the mean and 95 percentile time respectively.
 - (b) To establish the mean preventive maintenance time (MPMT): MIL-STD-471, test method 11 shall be used for testing the mean preventive maintenance time.
 - (c) The capability to correctly isolate faults using automatically initiated diagnostics as defined in 3.2.1.8.3.4. The demonstration procedures of MIL-STD-471 Notice 2 will be used for testing the above requirements with an 80 percent confidence interval.
- (5) The contractor shall design plans whereby fault simulation for corrective maintenance tasks shall be performed by the introduction of faulty parts, and deliberate misalignment, (bugging/etc.), as specified in MIL-STD-471.
- (6) A minimum of 100 samples shall be required for developing mean time to repair data for the tests specified in (a) and (b) above. Preventive maintenance will not be charged against time to repair for the tests specified in (a) and (b) above. The time to repair data will not include logistic delays, e.g., maintenance personnel, parts, and tools not being on-site.

4.2.1.1.3.1 Technicians. The Government reserves the right to provide and select the technicians to perform the equipment maintainability demonstration. Technicians to be selected will be provided by the Government from typical field locations. The contractor shall provide instruction on the equipment to qualify the technicians to perform prescribed system and equipment maintenance.

4.2.1.1.3.2 Technical documentation. Technical documentation to be used by the technicians shall be limited to the validated technical instruction manual/books prepared by the contractor for the system. No other notes or data sources are permitted. Marked up, red lined copies of the technical manuals are permitted for the demonstration.

4.2.1.1.3.3 Fault diagnostics. The ability to produce complete and specific fault diagnostics for each simulated fault shall be demonstrated during the maintainability demonstration.

4.2.1.1.3.4 Maintainability demonstration use of MPS and PMDT. RMS reports, including all parameters identified in 3.2.1.8.3.1 shall be transmitted to the FAA designated MPS and a logged on PMDT.

4.2.1.1.4 Integrity performance demonstration.

- (1) The contractor shall provide an integrity performance demonstration plan that is subject to Government approval.
- (2) The contractor shall perform the tests in the approved plan to validate the integrity performance predicted in the contractor's FMECA (specified in 3.2.5.1.5.3.2.2).
- (3) The tests shall consist of introducing failure modes into the azimuth, elevation, and DME/P equipments, while the MLS Ground System with Category III Conversion Kit installed is operating, after all initialization processes are completed.
- (4) The test shall be designed to demonstrate the following:
 - (a) The failure modes predicted in the FMECA to be in categories ii, iii and iv of 3.2.5.1.5.3.2.2(4) are, in fact, correctly categorized.
 - (b) The remaining failure modes are detected by the automatic integrity checks specified in 3.2.1.6.4.2.
- (5) The failure modes shall be randomly selected from the appropriate (as defined below for each test) subset of failure modes identified in the FMECA, with each failure mode given equal weighting.

4.2.1.1.3.1 Technicians. The Government reserves the right to provide and select the technicians to perform the equipment maintainability demonstration. Technicians to be selected will be provided by the Government from typical field locations. The contractor shall provide instruction on the equipment to qualify the technicians to perform prescribed system and equipment maintenance.

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- (3) The tests shall consist of introducing failure modes into the azimuth, elevation, and DME/P equipments, while the MLS Ground System with Category III Conversion Kit installed is operating, after all initialization processes are completed.
- (4) The test shall be designed to demonstrate the following:
 - (a) The failure modes predicted in the FMECA to be in categories ii, iii and iv of 3.2.5.1.5.3.2.2(4) are, in fact, correctly categorized.
 - (b) The remaining failure modes are detected by the automatic integrity checks specified in 3.2.1.6.4.2.
- (5) The failure modes shall be randomly selected from the appropriate (as defined below for each test) subset of failure modes identified in the FMECA, with each failure mode given equal weighting.

- (4) Any duplicate selections, including equivalent azimuth/elevation failure modes, shall be replaced by additional random selections. The Government may select up to 10 additional failure modes to be included in the automatic-integrity-check test for each equipment.
- (5) Any failure modes found in the demonstration to actually be fail safe, although not categorized in iii or iv of the FMECA shall not be used in this test; instead replacement failure modes shall be randomly selected.
- (6) If any of the selected failure modes are found in the demonstration to not be detected by the automatic integrity checks as specified in 3.2.1.6.4.2, the test shall be considered a failure.

4.2.1.1.5 System tests.

- (1) Each production MLS Ground System, with all elements interconnected, (including the executive and maintenance monitoring equipment and the RMS), shall be subjected to a system test at the contractor's plant.
- (2) System test shall be conducted on Category III equipment with primary and secondary equipment connected.
- (3) System test performed during Type Normal Testing shall be conducted with the MLS Ground System connected to a Back Azimuth Station and associated Elevation Station.
- (4) The system test shall be conducted to verify the requirements specified in 3.2.1.1.3, 3.2.1.1.12, 3.2.1.5.1.2.1, 3.2.1.5.2.2, 3.2.1.6.3, and 3.2.1.8.
- (5) This test shall be performed at the transmitter frequency assigned by the Government.

4.2.1.1.6 Multiple design interface test.

- (1) The Contractor shall conduct tests to verify that the dual REU interface operates in accordance with the multiple design interoperability section of this specification (3.2.2.1.2).
- (2) As a minimum, two REUs shall be interconnected; one shall be configured as a Master REU and the other shall be configured as a Slave REU.

4.2.2 Azimuth and elevation. The objective of these quality control systems and programs shall include, but not limited to, the validation of

signal format, RF characteristics, accuracy and coverage requirements contained in this specification and FAA-STD-022.

4.2.2.1 Detailed requirements. The following tests and conditions shall be included in either the First Article, RMS, or Turnkey Installation test plans. Some tests will be required in more than one plan, as specified below. Appendix C summarizes the tests required.

4.2.2.1.1 Test frequencies for design qualification and type tests.

- (1) The design qualification under normal test, as specified in FAA-G-2100, Table II, conditions shall be performed at each of the following five different frequencies: 5031.0 MHz, 5047.8 MHz, 5061.0 MHz, 5075.7 MHz, and 5090.7 MHz.
- (2) Type tests under normal test conditions shall be performed at each of the following three frequencies: 5031.0 MHz, 5061.0 MHz and 5090.7 MHz.
- (3) All temperature and humidity tests shall be performed at a frequency of 5061.0 MHz.

4.2.2.1.2 Test frequencies for production tests. All production equipment shall be tested at the transmitter frequency assigned by the government.

4.2.2.1.3 System factory test range tests. Measurements shall be performed on a suitable antenna range to demonstrate the ability of each type of equipment specified in Table 6 to satisfy the coverage, accuracy and beam shape characteristics required by this specification. Specific tests are detailed below.

4.2.2.1.3.1 Coverage.

- (1) Effective radiated power (ERP) shall be measured at least at the nine points indicated by an (x) in Figure 6 for azimuth antennas providing ± 40 degrees coverage.
- (2) For azimuth antennas providing ± 60 degrees coverage and all elevation antennas, an additional six points shall be measured as indicated in Figure 6. ERP can be demonstrated by a combination of measured transmitter power, (including all interconnect cables losses), and the net antenna gain measured at the points indicated in Figure 6.

4.2.2.1.3.2 Accuracy. Tests for horizontal coverage accuracy and vertical coverage accuracy shall be as specified in 4.2.2.1.3.2.1 and 4.2.2.1.3.2.2.

4.2.2.1.3.2.1 Horizontal coverage accuracy test.

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- (1) The design qualification under normal test, as specified in FAA-G-2100, Table II, conditions shall be performed at each of the following five different frequencies: 5031.0 MHz, 5047.8 MHz, 5061.0 MHz, 5075.7 MHz, and 5090.7 MHz.
- (2) Type tests under normal test conditions shall be performed at each of the following three frequencies: 5031.0 MHz, 5061.0 MHz and 5090.7 MHz.
- (3) All temperature and humidity tests shall be performed at a frequency of 5061.0 MHz.

4.2.2.1.2 Test frequencies for production tests. All production equipment shall be tested at the transmitter frequency assigned by the government.

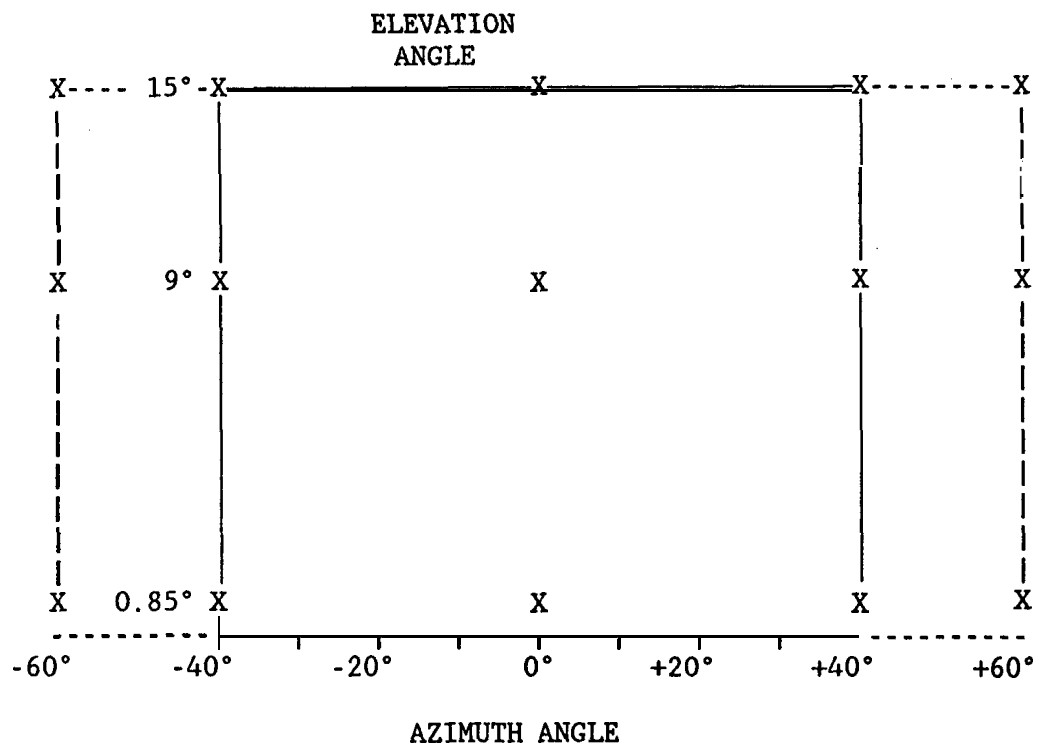
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4.2.2.1.3.2 Accuracy. Tests for horizontal coverage accuracy and vertical coverage accuracy shall be as specified in 4.2.2.1.3.2.1 and 4.2.2.1.3.2.2.

4.2.2.1.3.2.1 Horizontal coverage accuracy test.



X=Required Measurement Point

NOTE: Measurement points on dashed lines apply only to antennas providing $\pm 60^\circ$ of lateral coverage.

FIGURE 6 MINIMUM MEASUREMENT POINTS TO VERIFY COMPLIANCE WITH ERP REQUIREMENTS (AZIMUTH/ELEVATION)

- (4) The error evaluation period shall be 40 seconds for azimuth functions and 10 seconds for elevation.
- (5) For azimuth antennas during Type Normal testing, the receive antenna locations shall be 0° , $\pm 20^{\circ}$, $\pm 40^{\circ}$ and $\pm 60^{\circ}$ horizontal.
- (6) For azimuth and elevation antennas during Production testing, the receive antenna location shall be 0° horizontal.
- (7) For elevation antennas during Type Normal testing, the receive antenna location shall be 0° , $\pm 20^{\circ}$ and $\pm 40^{\circ}$ horizontal.
- (8) For the elevation antennas, compliance with 3.2.1.2.13.1.4 shall be demonstrated by performing the accuracy test with the receive antenna at 0° horizontal.

NOTE: For the purpose of 4.2.2.1.3.2.1 and 4.2.2.1.3.2.2, the term "measured angle errors" is defined to be the difference between the MLS receiver output taken at the function data rate, and the corresponding appropriate geometrical angle (azimuth or elevation) measured from the phase center of the antenna under test.

4.2.2.1.3.3 Scanning beam antenna sidelobe tests. Compliance with the effective sidelobe level requirements of 3.2.1.1.14.1.1(2) and 3.2.1.2.13.1.1(2) shall be demonstrated by performing the following two procedures.

4.2.2.1.3.3.1 Full coverage test.

- (1) Accuracy tests similar to those detailed in 4.2.2.1.3.2.1 and 4.2.2.1.3.2.2 shall be performed to verify that all pattern lobes in the plane of scan at a separation angle of more than two beamwidths satisfy the requirements with the receive antenna located at the specified points within the coverage volume.
- (2) For azimuth the receive antenna locations shall be 0, +40, and -40 degrees horizontal and +3 degrees vertical.
- (3) For elevation the receive antenna locations shall be 0 degrees horizontal and +2, +3, +6, and +9 degrees vertical.
- (4) Each test shall be conducted by generating a surrogate main beam at times corresponding to the angle of the receive antenna locations, adding it to the antenna generated RF in all relative phases in a suitable procedure, and rotating the scanning beam antenna through the required angular sector.

- (4) The error evaluation period shall be 40 seconds for azimuth functions and 10 seconds for elevation.
- (5) For azimuth antennas during Type Normal testing, the receive antenna locations shall be 0° , $\pm 20^{\circ}$, $\pm 40^{\circ}$ and $\pm 60^{\circ}$ horizontal.
- (6) For azimuth and elevation antennas during Production testing, the receive antenna location shall be 0° horizontal.
- (7) For elevation antennas during Type Normal testing, the receive antenna location shall be 0° , $\pm 20^{\circ}$ and $\pm 40^{\circ}$ horizontal.
- (8) For the elevation antennas, compliance with 3.2.1.2.13.1.4 shall be demonstrated by performing the accuracy test with the receive antenna at 0° horizontal.

NOTE: For the purpose of 4.2.2.1.3.2.1 and 4.2.2.1.3.2.2, the term "measured angle errors" is defined to be the difference between the MLS receiver output taken at the function data rate, and the corresponding appropriate geometrical angle (azimuth or elevation) measured from the phase center of the antenna under test.

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- (4) Each test shall be conducted by generating a surrogate main beam at times corresponding to the angle of the receive antenna locations, adding it to the antenna generated RF in all relative phases in a suitable procedure, and rotating the scanning beam antenna through the required angular sector.

4.2.2.1.5 Antenna tests.

- (1) For temperature and humidity tests of the azimuth and elevation antennas, two types of testing shall be performed. First, to show that stability requirements are satisfied at various temperatures, antenna measurements shall be accomplished after the antenna has stabilized at the following temperatures, in order: +30°C, -50°C, +50°C and +30°C with 100% RH, +30°C: which comprise one temperature cycle.
- (2) Second, as the temperatures are varied between these temperatures, continuous monitoring of the accuracy, as specified in 4.2.2.1.5.3 below shall be performed. This test verifies that accuracy is maintained at all intermediate temperatures.
- (3) The environmental test procedure (service conditions) in FAA-G-2100 shall apply for this test with the following changes;
 - (a) equipment shall remain in operation during the entire test,
 - (b) during the time when the temperature is being changed, readings shall be taken every 2 minutes per 4.2.2.1.5.3.

4.2.2.1.5.1 Stability of azimuth scanning beam antenna.

- (1) The contractor shall demonstrate compliance with 3.2.1.1.1.1 over the temperature cycle specified in 4.2.2.1.5.
- (2) This test shall be performed by mounting the antenna on the test range as it would be in a normal installation (same foundation, mounting fixtures etc.).
- (3) A minimum of 10 seconds of continuous data samples shall be taken for trial. The test consists of a least 10 trials equally spaced over a one hour period.
- (4) The mean value of the angle measurements during each sample period shall be computed.
- (5) The variation in the mean values during one temperature cycle shall not exceed the limits specified in 3.2.1.1.1.1.

4.2.2.1.5.2 Stability of elevation scanning beam antenna.

- (1) This test shall be identical to the stability test for the azimuth antenna, with the exception that this test shall demonstrate compliance with 3.2.1.2.1.1.
- (2) The variation in the mean values during one temperature cycle shall not exceed the limits specified in 3.2.1.2.1.1.

4.2.2.1.5 Antenna tests.

- (1) For temperature and humidity tests of the azimuth and elevation antennas, two types of testing shall be performed. First, to show that stability requirements are satisfied at various temperatures, antenna measurements shall be accomplished after the antenna has stabilized at the following temperatures, in order: +30°C, -50°C, +50°C and +30°C with 100% RH, +30°C: which comprise one temperature cycle.
- (2) Second, as the temperatures are varied between these temperatures, continuous monitoring of the accuracy, as specified in 4.2.2.1.5.3 below shall be performed. This test verifies that accuracy is maintained at all intermediate temperatures.
- (3) The environmental test procedure (service conditions) in FAA-G-2100 shall apply for this test with the following changes;
 - (a) equipment shall remain in operation during the entire test,
 - (b) during the time when the temperature is being changed, readings shall be taken every 2 minutes per 4.2.2.1.5.3.

4.2.2.1.5.1 Stability of azimuth scanning beam antenna.

- (1) The contractor shall demonstrate compliance with 3.2.1.1.1.1 over the temperature cycle specified in 4.2.2.1.5.
- (2) This test shall be performed by mounting the antenna on the test range as it would be in a normal installation (same foundation, mounting fixtures etc.).
- (3) A minimum of 10 seconds of continuous data samples shall be taken for trial. The test consists of a least 10 trials equally spaced over a one hour period.
- (4) The mean value of the angle measurements during each sample period shall be computed.
- (5) The variation in the mean values during one temperature cycle shall not exceed the limits specified in 3.2.1.1.1.1.

4.2.2.1.5.2 Stability of elevation scanning beam antenna.

- (1) This test shall be identical to the stability test for the azimuth antenna, with the exception that this test shall demonstrate compliance with 3.2.1.2.1.1.
- (2) The variation in the mean values during one temperature cycle shall not exceed the limits specified in 3.2.1.2.1.1.

4.2.3.1 Detailed requirements. The following tests and conditions shall be included in either the First Article, RMS, or Turnkey Installation test plans. Some tests will be required in more than one plan, as specified below. Appendix C summarizes the tests required.

4.2.3.1.1 Test frequencies for design qualification and type tests.

- (1) The design qualification and type tests under normal test conditions shall be performed at each of the following six different MLS channels: 500, 539, 556, 601, 648, and 699.
- (2) All temperature and humidity tests shall be performed on channel 601.

4.2.3.1.2 Test frequencies for production tests. All production equipment shall be tested on one of the following five channels: 500, 539, 648, 699, or the shipping frequency as selected by the government.

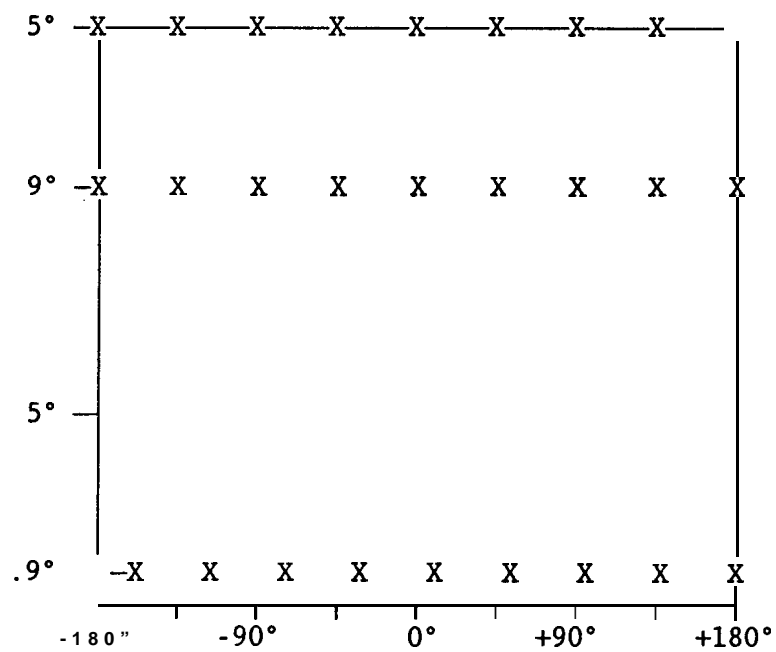
4.2.3.1.3 Antenna tests. Measurements shall be performed on a suitable antenna range to demonstrate the coverage characteristics required by this specification. Specific tests are detailed below.

4.2.3.1.3.1 Coverage.

- (1) Effective radiated power (ERP) shall be demonstrated at least at the points indicated by an (x) in Figure 7. ERP can be demonstrated by a combination of measured transmitter power, (including all interconnect cables losses), and the net installed antenna gain measured at the points indicated in Figure 7.
- (2) If antenna nulls occur at points other than the points indicated in Figure 7, additional demonstration points shall be included for the deepest null and for any structure generated nulls, (such as by an obstruction light pole).
- (3) Additional test points shall be provided as needed to satisfy requirements of subparts (c) and (d) of 3.2.1.4.4.1.5.

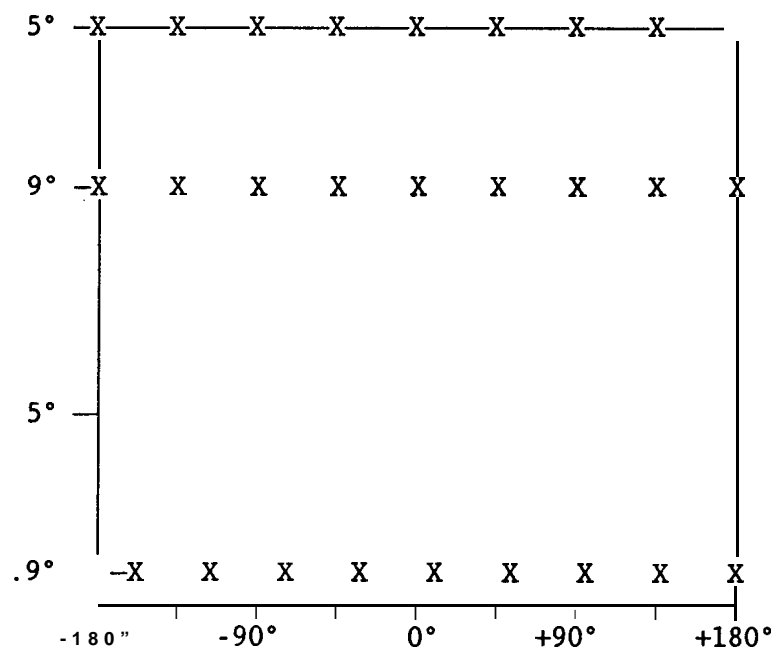
4.2.3.1.3.2 Accuracy.

- (1) The contractor shall demonstrate compliance with the requirements in a simulated rain condition (3.2.6.2(1)(b)) and over the environmental conditions listed in 3.2.6.1.1.
- (2) These special tests shall only be performed during design qualification and type testing; production tests need only be tested under normal ambient operating conditions. A combination of net installed antenna gain and the transponder measured performance may be used to demonstrate compliance.



X=Required Measurement Point

FIGURE 7 MINIMUM MEASUREMENT POINTS TO VERIFY COMPLIANCE WITH ERP REQUIREMENTS (DME/P)



X=Required Measurement Point

FIGURE 7 MINIMUM MEASUREMENT POINTS TO VERIFY COMPLIANCE WITH ERP REQUIREMENTS (DME/P)

4.3.1 Verification Test Levels. MLS testing shall be structured in the following test levels.

4.3.1.1 Design Qualification Test.

- (1) Tests shall be performed in accordance with FAA-G-2100, 4.3.2, to demonstrate that the design meets specified requirements.
- (2) The tests shall be performed over the range of service and normal conditions as indicated in the VRTM.

4.3.1.2 Type Testing.

- (1) Type tests shall verify compliance with specification requirements during the production phase of the program. Testing will be done on selected units sampled from the production line.
- (2) Units shall be selected for type tests in accordance with FAA-G-2100, paragraph 4.3.3.
- (3) The tests shall be performed over the range of service and normal conditions as indicated in the VRTM.

4.3.1.3 Production Test.

- (1) Production tests shall verify that production units are in compliance with the requirements of the specification.
- (2) All production units shall be tested as required by FAA-G-2100, paragraph 4.3.4. Tests are done under normal conditions.

4.3.1.4 Site Acceptance Test (SAT). Site acceptance tests shall verify that the system is performing its specified functions, as installed in the field.

4.3.2 Verification Methods. The following is a methodology used to verify adherence to requirements specified in Section 3. The verification methods include inspection, test, demonstration and analysis.

- (1) These verification methods shall be mandatory for use in all testing of the MLS.
- (2) Pass/fail criteria for each requirement shall be defined and placed in the appropriate verification documentation.
- (3) Failure to "pass" the appropriate verification action(s) (inspection, test, demonstration, or analysis) shall be cause for rejection.

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- (2) Pass/fail criteria for each requirement shall be defined and placed in the appropriate verification documentation.
- (3) Failure to "pass" the appropriate verification action(s) (inspection, test, demonstration, or analysis) shall be cause for rejection.

4.3.2.3.1 Hardware.

- (1) Hardware demonstration shall determine the qualitative characteristics of end-item or component properties by observation.
- (2) Demonstration shall not require special test equipment or instruction to verify characteristics such as operational performance, human engineering features, service, access features, and transportability.

4.3.2.3.2 Software.

- (1) Software demonstration shall determine compliance with requirements (e.g., the proper response at a site as a result of a specified interrogation or command to be processed by the program) through observation of functional operation.
- (2) Demonstration shall be used primarily for activities where data gathering is not appropriate, such as CRT display verification.

4.3.2.4 Analysis.

4.3.2.4.1 Hardware. Hardware analysis shall encompass any or all of the following.

4.3.2.4.1.1 Engineering Analysis.

- (1) This type of analysis shall involve an engineering design function involving study, calculation, or modeling of the known or potential failure modes, and reaction or interactions of the specified parts, materials, and the design configuration with the known function, performance and/or probable effects of the operational environments.
- (2) This analysis shall normally be used to verify margins when it is not desirable to test to failure.

4.3.2.4.1.2 Similarity Analysis. Similarity analysis shall be a method applied to end-items or components that are identical in design and manufacturing processes to end-items or components that have been previously qualified to equivalent or more stringent requirements.

4.3.2.4.1.3 Validation of Records Analysis. Validation of records analysis shall be a method of verification wherein manufacturing records are used to verify compliance, concealed construction features, or processes of manufacturing (e.g., vendor items).

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- (2) This analysis shall normally be used to verify margins when it is not desirable to test to failure.

4.3.2.4.1.2 Similarity Analysis. Similarity analysis shall be a method applied to end-items or components that are identical in design and manufacturing processes to end-items or components that have been previously qualified to equivalent or more stringent requirements.

4.3.2.4.1.3 Validation of Records Analysis. Validation of records analysis shall be a method of verification wherein manufacturing records are used to verify compliance, concealed construction features, or processes of manufacturing (e.g., vendor items).

5 PREPARATION FOR DELIVERY.

5.1 Preservation, packaging, packing, and marking.

- (1) Preservation, packaging, packing and marking of equipment, components and spares shall be performed as follows.
- (2) All equipment, components, and spares shipped to the sites shall be packaged in accordance with (IAW) ASTM D 3951 and marked IAW the supplemental requirements of ASTM D 3951.
- (3) In the event the site's material is shipped to the Depot for storage, it shall be packaged and marked as stated in items 4 through 10.
- (4) All components and equipment (except spares) marked for FAA Depot storage shall be individually preserved and packaged level A and packed level B IAW MIL-E-17555.
- (5) Spares marked for FAA Depot storage shall be preserved and packaged level A and packed level C IAW MIL-E-17555.
- (6) Common hardware items shall be packaged in multiple unit pack quantities as normally supplied through retail trade channels or in standard commercial unit pack quantities compatible with the unit of issue. Appendix F of MIL-STD-794 will be used as a guide in determining the standard quantity per unit container. (Bulk quantities not acceptable.)
- (7) Kits shall be preserved and packaged level A and packed level C IAW Appendix E of MIL-STD-794.
- (8) All items identified as Electrostatic Discharge Sensitive (ESDs) shall be preserved/packaged/packed and marked IAW all applicable documents referenced in MIL-E-17555.
- (9) All materials marked for FAA Depot storage shall be marked IAW MIL-STD-129 and MIL-STD-1189.
- (10) In addition to MIL-STD-129 and MIL-STD-1189, each container, intermediate, and exterior shipping container shall be marked with the following, as applicable.
 - (a) Serial Number
 - (b) Part Number
 - (c) Warranty Expiration Date
 - (d) Contract Number
 - (e) Contract Line Item Number

FAA-E-2721B
August 30, 1990

5.2 Transportation. The FAA Depot will ensure that Transportation Mode Selected (TMS) and spare parts stored at the Depot are shipped by the most economical means consistent with established FAA and DOT transportation guidelines.

FAA-E-2721B
August 30, 1990

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FAA-E-2721B
August 30, 1990

PM	PREVENTIVE MAINTENANCE
PMDT	PORTABLE MAINTENANCE DATA TERMINAL
PMR	PORTABLE MLS RECEIVER
RCSU	REMOTE CONTROL AND STATUS UNIT
REU	REMOTE CONTROL AND STATUS UNIT ELECTRONICS UNIT
RF	RADIO FREQUENCY
RMMS	REMOTE MAINTENANCE MONITORING SYSTEM
RMS	REMOTE MONITORING SUBSYSTEM
RSU	REMOTE STATUS UNIT
TLP	TRANSMISSION LEVEL POINT
TMS	TRANSPORTATION MODE SELECTED
TDM	TIME DIVISION MULTIPLEXING
UID	USER IDENTIFICATION
VRTM	VERIFICATION REQUIREMENTS TRACEABILITY MATRIX
WDM	WAVELENGTH DIVISION MULTIPLEXING

FAA-E-2721B
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UID	USER IDENTIFICATION
VRTM	VERIFICATION REQUIREMENTS TRACEABILITY MATRIX
WDM	WAVELENGTH DIVISION MULTIPLEXING

10.8 Elevation equipment/station. That portion of the MLS Ground System/system that transmits and monitors elevation guidance signals in accordance with FAA-STD-022 and this specification.

10.9 End-to-end integrity check. A check that verifies the proper operation of each active monitor channel, any monitor voting logic and control circuits.

10.10 Environmental controls. Air conditioners, heaters, dehumidifiers, fans, blowers, or other devices which are provided in order to modify and control the immediate operating environment of a complete equipment set. Typically, the interior of an equipment cabinet, shelter, or room is controlled by such devices.

10.11 Equipment Off. The process whereby an individual equipment ceases radiating.

10.12 Equipment On. The process whereby an individual equipment has been initialized, all alarm conditions, alert conditions and monitor readings cleared; and has begun radiating.

10.13 Equipment restart. The attempt to radiate guidance and data functions after an equipment shutdown due to an integrity alarm condition. A restart will cause individual equipment (azimuth, elevation, back azimuth, or DME/P) to clear all alarm and alert conditions, clear all monitor readings and resume radiation in the equipment mode appropriate for the control master (normal or test).

10.14 Equivalent Isotropically Radiated Power. The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna.

10.15 Executive monitor. That equipment which assures that erroneous guidance or data are not transmitted for longer time periods than are operationally acceptable.

10.16 Extraneous-Pulse Garbling. With respect to the desired on-channel interrogations, the simultaneous occurrence of undesired on-frequency/off-frequency pulses produced by interrogators operating with other transponders in the vicinity of the reference transponder or by other pulse type systems operating in the same 960-1215 MHz frequency band.

10.17 Field sensor. A sensor sited remotely from the antenna, with enough sensitivity to detect erroneous signal conditions.

10.18 Final Approach (FA) mode. The DME/P mode of operation which is characterized by wide bandwidth processing of signals and time delays

(both interrogated range measurement and transponder reply delay) are based on measurements at the virtual origin of the pulse.

10.19 Firmware. Hardware that contains a computer program and data that cannot be changed in the user environment.

10.20 Function Overlap. A change in function synchronization by greater than ± 100 μ seconds.

10.21 Garbling. Interfering pulses from either normal transponder interrogation loading or other extraneous-pulses existing in the environment, causing performance degradation affecting both accuracy and reply efficiency.

10.22 Hard Alarms. Hard alarms are out of tolerance conditions for integrity parameters and secondary parameters, and failure indications for environmental parameters.

10.23 Historical performance file. The RMS function that stores an equipment's historical performance records.

10.24 Initial Approach (IA) mode. The DME/P mode of operation which is similar a conventional DME (DME/N) operation where narrow band processing is used, and time delays (both interrogated range measurement and transponder reply delay) are based on measurements at the 50 percent of maximum voltage amplitude level on the pulse leading edge.

10.25 Integral sensor. A sensor located within the antenna aperture which samples the radiated signal for monitoring purposes.

10.26 Integrity. The probability that the MLS Ground System will not radiate hazardous MLS guidance or data signals during any landing operation. Hazardous guidance includes any out-of-tolerance condition that could result in erroneous guidance and is not clearly recognizable by the automatic flight control system or pilot.

10.27 Integrity alarm. Occurs when any of the integrity parameters is out of tolerance and appropriate control action is taken to inhibit the erroneous radiation.

10.28 Interrogation signal. A pulse pair radiated by a DME interrogator and which has characteristics as shown in Appendix B.

10.29 I/O port. A place of access to a device or network (e.g. from the perspective of a microprocessor this also can be an address/memory location).

10.30 Key down time. The time interval during which a "dot" or "dash" of a Morse code character is being transmitted.

(both interrogated range measurement and transponder reply delay) are based on measurements at the virtual origin of the pulse.

10.19 Firmware. Hardware that contains a computer program and data that cannot be changed in the user environment.

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10.40 Mean Time Between Critical Failure - Degradation in Category of Operation (MTBCF-DCO). The total up-time divided by the total number of failures which cause, or should cause, a degradation in Azimuth, Elevation or DME/P equipment Category (I, II, III) of Operation. MTBCF-DCO equals the Continuity of Service equivalent Mean Time Between Outages only for equipments with no redundancy.

10.41 Mean Time Between Critical Failure - Loss of Function (MTBCF-LF). total system up-time divided by failures which cause loss of Remote Monitoring Subsystem and Remote Control and Status capabilities. MTBCF-LF also includes critical failures which are not included as MTBCF-DCO.

10.42 Mean Time Between Failure (MBTF). The total system up-time divided by the number of part failures.

10.43 Measurement period. The period of time used to acquire samples of a parameter.

10.44 Message buffer. The Remote Monitoring Subsystem (RMS) function that stores formatted messages and responses which are awaiting transmission from the Remote Control and Status Unit Electronics Unit (REU).

10.45 Microwave Landing System. The complete set of Ground System and avionics that is required to provide precision approach and landing service to aircraft.

10.46 MLS avionics. The complete set of equipment in the aircraft that is required to receive, interpret and display MLS guidance signals.

10.47 MLS Ground System. The complete set of equipment on the ground that is required to transmit, monitor, and control MLS guidance and data signals and interface with the Maintenance Processor System (MPS).

10.48 Module. An assembly of two or more parts that form a plug-in unit which can be quickly and easily removed intact and replaced by another identical module.

10.49 Monitor Bypass. MLS state where shutdown due to hard alarm conditions is inhibited. In this state, the executive monitor continues to function normally.

10.50 Normal mode. The equipment is under operational control, and when radiating, is radiating its normal signal with the monitor operating.

10.51 Offline Equipment. For runways with MLS Ground Systems on both ends, the elevation and DME/P equipments associated with the back

azimuth are designated as offline equipment. These equipments are not radiating.

10.52 On-channel interrogation/reply. A pulse pair with the proper radio frequency and pulse coding characteristics for the channel in use.

10.53 Operational control. Equipment control mastership is located at the Remote Control and Status Unit (RCSU) panel.

10.54 Outage. Unscheduled interruption of the guidance signal for more than one second.

10.55 Outlier window. A processing window used to reject path following error (PFE) and control motion noise (CMN) measurement samples having physically unrealistic magnitudes of deviation from the nominal.

10.56 Overlap. Whenever two separate functions, (e.g., azimuth and elevation), are radiated simultaneously.

10.57 Path following error (PFE). That portion of the guidance signal error which could cause aircraft displacement from the desired course or glide path. These perturbations fall within the loop guidance bandwidth of an aircraft. The path following error is composed of the path following noise and the mean course error, in the case of azimuth functions; or the mean glide path error, in the case of elevation functions (PFE measurement methodology is defined in FAA-STD-022, paragraph 6).

10.58 Peak envelope Power (Power Density). The average power (power density) supplied during one cycle at the crest of the modulation envelope.

10.59 Portable Maintenance Data Terminal (PMDT). The PMDT is a MS-DOS compatible microcomputer system provided by the government to enable maintenance technicians to interface with the RMS.

10.60 Primary equipment. The one of two identical equipments in a standby configuration that is selected to radiate upon equipment initialization.

10.61 Pulse coding. The time between pulses of a pulse pair as measured between the 50 percent maximum voltage amplitude point on the leading edge of the first RF pulse and the corresponding point on the leading edge of the second RF pulse.

10.62 Reaction time. The time period between the occurrence of an out-of-tolerance condition and equipment shut-down by executive monitor action.

azimuth are designated as offline equipment. These equipments are not radiating.

10.52 On-channel interrogation/reply. A pulse pair with the proper radio frequency and pulse coding characteristics for the channel in use.

10.53 Operational control. Equipment control mastership is located at the Remote Control and Status Unit (RCSU) panel.

10.54 Outage. Unscheduled interruption of the guidance signal for more than one second.

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10.60 Primary equipment. The one of two identical equipments in a standby configuration that is selected to radiate upon equipment initialization.

10.61 Pulse coding. The time between pulses of a pulse pair as measured between the 50 percent maximum voltage amplitude point on the leading edge of the first RF pulse and the corresponding point on the leading edge of the second RF pulse.

10.62 Reaction time. The time period between the occurrence of an out-of-tolerance condition and equipment shut-down by executive monitor action.

10.69 Secondary alert. Occurs when any of the secondary parameters is out of tolerance and appropriate control action is taken to inhibit the erroneous radiation.

10.70 Secondary equipment. The one of two identical equipment in a standby configuration which will normally radiate upon switchover from the primary.

10.71 Site specific parameter values. Site specific parameter values include antenna type, equipment Category (II or III) and other information required to complete the Basic and Auxiliary Data Words.

10.72 Soft alarm. Out of tolerance condition for maintenance and environmental parameters, which indicate that a trend towards failure exists.

10.73 Special Test Equipment. Electronic or electrical test equipment which does not qualify as common test equipment.

10.74 Squitter. Randomly generated pulse pairs which are used to maintain a minimum pulse pair transmission rate by the transponder.

10.75 Standby configuration. An equipment configuration where two identical equipments, designated primary and secondary, are available for use. Both equipments are energized continuously; however, only the primary radiates until switchover due to a failure.

10.76 Support Equipment. Common and special tools, jigs, fixtures, software development equipment and facilities, and material handling equipment required for performing operational and maintenance tasks at all levels.

10.77 System efficiency. The ratio of on-channel replies processed by an interrogator to the total of its own interrogations.

10.78 Test mode. The equipment is under maintenance control and has a change in its radiation characteristics to inhibit its use by commercial avionics equipment.

10.79 Transponder Loaded Condition. The DME/P transponder is considered loaded from that point where the squitter is completely replaced with valid replies up to the specified maximum transponder capacity.

10.80 Transponder Unloaded Condition. The DME/P transponder is considered unloaded when there is an absence of all interrogations, except those from a single reference interrogator.

10.81 Threshold Sensitivity. The minimum RF power level of interrogation signals from a single reference interrogator required at the

receiver input that results in DME/P transponder replies which meet all DME/P accuracy and all reply efficiency requirements.

10.82 Valid interrogation/reply. The same as "on-channel interrogation/reply".

10.83 Virtual origin. That point in time, associated with the leading edge of the pulse, where the linear extension of a straight line through the points at 5 percent and 30 percent of the maximum voltage amplitude of the pulse intersects the zero voltage axis, (See Figure A-1).

receiver input that results in DME/P transponder replies which meet all DME/P accuracy and all reply efficiency requirements.

10.82 Valid interrogation/reply. The same as "on-channel interrogation/reply".

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APPENDIX B

20 CHARACTERISTICS OF AIRBORNE DME/P INTERROGATOR.

20.1 Radio frequency. The center radio frequency of the interrogation signal is within 100 KHz of the interrogation frequency listed in Table 12 of FAA-STD-022 for the channel in use.

20.2 Radio frequency pulse spectrum. The RF spectrum of the interrogation signal is such that not less than 90 percent of the energy in each pulse is within a 500 KHz band centered on the channel interrogation signal frequency and in which each additional lobe of the spectrum is of lesser amplitude than the adjacent lobe nearer the channel frequency.

20.3 RF pulse shape. The RF envelope of each pulse, as detected by a linear detector, has a shape falling within the limits specified herein, (See Figure 3).

20.3.1 Pulse rise time.

20.3.1.1 DME/N. The pulse rise time is not more than 3.0 μ sec.

20.3.1.2 DME/P. The pulse rise time is between 0.8 μ sec and 1.2 μ sec.

20.3.1.3 DME/P FA mode. The pulse partial rise time is between 0.20 and 0.30 μ sec. The slope of the pulse in this region does not vary more than plus or minus 20 percent.

20.3.2 Pulse top. The amplitude of the pulse does not, at any instant between the point on the leading edge, which is 95 percent of the maximum voltage amplitude, and the point on the trailing edge, which is 95 percent of the maximum voltage amplitude, fall below a value which is 95 percent of the maximum voltage amplitude.

20.3.3 Pulse width. The pulse width is 3.5 \pm 0.5 μ sec.

20.3.4 Pulse decay time. The pulse decay time is nominally 2.5 μ sec, but does not exceed 3.5 μ sec.

20.3.5 Pulse Pedestal. If there is a pulse pedestal or a pulse turn-on transient which occurs in time prior to the virtual origin, the amplitude shall be -40 dB or less relative to the pulse peak amplitude and shall not commence more than 1000 nanoseconds prior to the virtual origin.

APPENDIX B

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20.3.1.3 DME/P FA mode. The pulse partial rise time is between 0.20 and 0.30 μ sec. The slope of the pulse in this region does not vary more than plus or minus 20 percent.

20.3.2 Pulse top. The amplitude of the pulse does not, at any instant between the point on the leading edge, which is 95 percent of the maximum voltage amplitude, and the point on the trailing edge, which is 95 percent of the maximum voltage amplitude, fall below a value which is 95 percent of the maximum voltage amplitude.

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APPENDIX C

30 VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM). The following matrix indicates the method by which each requirement will be verified.

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30 VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM). The following matrix indicates the method by which each requirement will be verified.

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.1.1.1	(4) Requirements met with max nr. of failed phase shifters in worst case locations	T		T	T	T		Title Perform over 3 continuous cycles Perform over 1 continuous cycle Title
	Accuracy stability							
	(1) Azimuth antenna							
	(2) Mean value of the angle							
3.2.1.1.2.	Antenna design features							
3.2.1.1.2.1	Aperture		I					
3.2.1.1.2.2	Beam steering		I					
3.2.1.1.2.3	Environmental effects		A					
3.2.1.1.2.4	Grating lobes							Title
	(1) Lobe suppression, only main lobe acquired		T					
	(2) Maximum number of failed phase shifters		T					
3.2.1.1.3.	Function Synchronization	T		T		T		Include in System Test
3.2.1.1.3.1	Transmission cycle							Title
	(1) Time synchronization	T		T		T		Include in System Test
	(2) Cycle synchronization	T		T		T		Include in System Test
	(a) Back Azimuth and Basic Data Word 2	T		T		T	D	Include in System Test
	(b) Back Azimuth Synchronization	T		T		T	D	Include in System Test
	(c) Radiation of Back Azimuth Basic & Aux Data	T		T		T	D	Include in System Test
	(d) Alternative synchronization							Information only

VERIFICATION METHODS: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, C=CONTRACTOR DETERMINES METHOD OF VERIFICATION, L=REQUIREMENT SATISFIED BY LOWER LEVEL REQUIREMENT, S=REDUNDANT REQUIREMENT, N/A=NOT APPLICABLE

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE CCEPT.	
		ERVICE	ORMAL	ERVICE	ORMAL			
3. 2. 1. 1. 3. 2	Stability	T		T			D	Title Title

VERIFICATION METHODS: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, C=CONTRACTOR DETERMINES METHOD OF VERIFICATION, L=REQUIREMENT SATISFIED BY LOWER LEVEL REQUIREMENT, S=REDUNDANT REQUIREMENT, N/A=NOT APPLICABLE

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE CCEPT.	
		ERVICE	IORMAL	ERVICE	ORMAL			
3. 2. 1. 1. 3. 2	Stability	T		T			D	Title Title.
3. 2. 1. 1. 5	Angle Guidance Signal		T					
3. 2. 1. 1. 6.	Transmitter requirements							
3. 2. 1. 1. 6. 1	Channel selection							
	(1) 200 channels			T				
	(2) Devices and controls			D				
	(3) Channel selection			D				
3. 2. 1. 1. 6. 2.	Minimun output power				T		T	D
3. 2. 1. 1. 6. 3.	Output power adjustment			T			D	
3. 2. 1. 1. 6. 4	Radio frequency signal spectrum					T		
3. 2. 1. 1. 6. 5	Modulation					T		
3. 2. 1. 1. 6. 6	Frequency tolerance				T		T	
3. 2. 1. 1. 6. 7	Residual radiation					T		
3. 2. 1. 1. 7.	Field monitor							Lead-In
	(1) Distance between transmitting and field monitor antenna			A				
	(2) Located within lateral coverage		D					
	(3) Design to minimize effect of multipath		A					
	(4) Minimize its blockage of radiated signals		A					
	(5) Connection provide at the base					D		
	(6) Includes a tilt mechanism		D					
	(7) Meets the LIRS requirements		A, T, I					
	(8) Field monitor used for error correction		A					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE CCEPT.	
PARAGRAPH NO.	TITLE	ERVICE	ORMAL	ERVICE	ORMAL	PRODUCTION	SITE CCEPT.	REMARKS
3.2.1.1.10.4.	(3) Operating of AZ and elevation stations without power supply		T					Title
	(4) Battery not to affect MLS operation			T				
3.2.1.1.10.5.	Voltage regulators		I					Title
	(1) No ext. volt requirements		I					
3.2.1.1.11.	(2) Volt regulation methods		I					Repeat Tests 3.2.1.1.3.1 and 3.2.1.1.12
	Convenience outlets		I					
3.2.1.1.12.	(1) Type of outlets		I					Title, Repeat Tests: 3.2.1.1.3.1, 3.2.1.1.13.1, 3.2.1.5.1.2
	(2) Compliance with FAA-C-1217		I					
3.2.1.1.13.	(3) Outlets and wiring IAW FAA-G-2100		I					Include in System Test
	Low rate approach azimuth and high rate approach azimuth modes		T					
3.2.1.1.13.1.	Approach azimuth and back azimuth							Titie
	(1) Switchability		T					
3.2.1.1.13.1.	(2) Operate on the same frequency		T					Include in System Test
	Coverage							
3.2.1.1.13.1.	(1) proportional coverage			T		T	T	
	(2) ERP			T		T	T	
3.2.1.1.13.1.	(3) Phase shifter failures			T				
3.2.1.1.13.1.	Proportional guidance		T					

VERIFICATION METHODS: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, C=CONTRACTOR DETERMINES METHOD OF VERIFICATION, L=REQUIREMENT SATISFIED BY LOWER LEVEL REQUIREMENT, S=REDUNDANT REQUIREMENT, N/A=NOT APPLICABLE

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE CCEPT.	
PARAGRAPH NO.	TITLE	ERVICE	ORMAL	ERVICE	ORMAL			
3.2.1.1.10.4.	(3) Operating of AZ and elevation stations without power supply		T					Title
	(4) Battery not to affect MLS operation			T				
3.2.1.1.10.5.	Voltage regulators		I					Title
	(1) No ext. volt requirements		I					
3.2.1.1.11.	(2) Volt regulation methods		I					Repeat Tests 3.2.1.1.3.1 and 3.2.1.1.12
	Convenience outlets		I					
3.2.1.1.12.	(1) Type of outlets		I					Title, Repeat Tests: 3.2.1.1.3.1, 3.2.1.1.13.1, 3.2.1.5.1.2
	(2) Compliance with FAA-C-1217		I					
3.2.1.1.13.	(3) Outlets and wiring IAW FAA-G-2100		I					Include in System Test
	Low rate approach azimuth and high rate approach azimuth modes		T					
3.2.1.1.13.1.	Approach azimuth and back azimuth							Titie
	(1) Switchability		T					
3.2.1.1.13.1.	(2) Operate on the same frequency		T					Include in System Test
	Coverage							
3.2.1.1.13.1.	(1) proportional coverage			T				
	(2) ERP			T				
3.2.1.1.13.1.	(3) Phase shifter failures			T				
	Proportional guidance		T					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD				REMARKS		
		DESIGN		TYPE			PRODUCTION	SITE ACCEPT.
		SERVICE	ORMAL	SERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3. 2. 1. 1. 14. 1. 2	(2) Sidelobe Level						Title Azimuth Angle 0'	
	(a) Dynamic Sidelobes			T	T			
	(b) Effective Sidelobes			T	T			
	(3) Vertical Radiation Pattern						Title	
	(a) Free space radiation pattern				T			
	(b) Slope at 6 dB below peak				T			
	(c) Angles between 1st and 2nd nulls				T			
	(d) Angles below 2nd null				T			
	Alignment and tilt controls						Title	
	(1) Support structure provision		D					
(2) Precise alignment		D						
(3) Mean error of contiguous data		T				T		
(4) Az antenna boresight adjustments						Lead-in		
(a) Electrical/Steerable in Az		T						
(b) Mechanical		T						
3. 2. 1. 1. 14. 1. 3	Antenna stability	A						
3. 2. 1. 1. 14. 1. 4	Polarization				T			

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD				REMARKS		
		DESIGN		TYPE			PRODUCTION	SITE ACCEPT.
		SERVICE	ORMAL	SERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3. 2. 1. 1. 14. 1. 2	(2) Sidelobe Level						Title Azimuth Angle 0'	
	(a) Dynamic Sidelobes			T	T			
	(b) Effective Sidelobes			T	T			
	(3) Vertical Radiation Pattern						Title	
	(a) Free space radiation pattern				T			
	(b) Slope at 6 dB below peak				T			
	(c) Angles between 1st and 2nd nulls				T			
	(d) Angles below 2nd null				T			
	Alignment and tilt controls						Title	
	(1) Support structure provision		D					
(2) Precise alignment		D						
(3) Mean error of contiguous data		T				T		
(4) Az antenna boresight adjustments						Lead-in		
(a) Electrical/Steerable in Az		T						
(b) Mechanical		T						
3. 2. 1. 1. 14. 1. 3	Antenna stability	A						
3. 2. 1. 1. 14. 1. 4	Polarization				T			

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEP.T.	
		ERVICE	ORMAL	ERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.2.6.1.	Channel selection							See 3.2.1.1.6.1
3.2.1.2.6.2.	Minimum output power							See 3.2.1.1.6.2
3.2.1.2.6.3.	Output power adjustment							See 3.2.1.1.6.3
3.2.1.2.6.4	Radio frequency signal spectrum							See 3.2.1.2.6.4
3.2.1.2.6.5.	Modulation							See 3.2.1.2.6.5
3.2.1.2.6.6.	Frequency tolerance							See 3.2.1.2.6.6
3.2.1.2.6.7.	Residual radiation							See 3.2.1.2.6.7
3.2.1.2.7.	Field monitor							See 3.2.1.1.7
3.2.1.2.9.	Equipment Stabilization							Title
	(1) Power on start up		T					
	(2) Power off start up		T					
3.2.1.2.10.	Station power							See 3.2.1.1.10
3.2.1.2.10.1.	Site and equipment power							See 3.2.1.1.10.1
3.2.1.2.10.2.	Battery supply							See 3.2.1.1.10.2
3.2.1.2.10.3.	Power supply							See 3.2.1.1.10.3
3.2.1.2.10.4.	Voltage regulators							See 3.2.1.1.10.4
3.2.1.2.10.5.	Convenience outlets							See 3.2.1.1.10.5
3.2.1.2.11.	Coverage							Title
	(1) proportional guidance				T		T	
	(2) Adjustment of lower scan limit				T		T	
	(3) ERP				T		T	

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
		ERVICE	ORMAL	ERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.2.6.1.	Channel selection		T T					See 3.2.1.1.6.1
3.2.1.2.6.2.	Minimum output power							See 3.2.1.1.6.2
3.2.1.2.6.3.	Output power adjustment							See 3.2.1.1.6.3
3.2.1.2.6.4.	Radio frequency signal spectrum							See 3.2.1.2.6.4
3.2.1.2.6.5.	Modulation							See 3.2.1.2.6.5
3.2.1.2.6.6.	Frequency tolerance							See 3.2.1.2.6.6
3.2.1.2.6.7.	Residual radiation							See 3.2.1.2.6.7
3.2.1.2.7.	Field monitor							See 3.2.1.1.7
3.2.1.2.9.	Equipment Stabilization							Title
	(1) Power on start up							
	(2) Power off start up							
3.2.1.2.10.	Station power							See 3.2.1.1.10
3.2.1.2.10.1.	Site and equipment power							See 3.2.1.1.10.1
3.2.1.2.10.2.	Battery supply							See 3.2.1.1.10.2
3.2.1.2.10.3.	Power supply							See 3.2.1.1.10.3
3.2.1.2.10.4.	Voltage regulators						See 3.2.1.1.10.4	
3.2.1.2.10.5.	Convenience outlets						See 3.2.1.1.10.5	
3.2.1.2.11.	Coverage						Title	
	(1) proportional guidance				T	T	T	
	(2) Adjustment of lower scan limit				T	T	T	
	(3) ERP				T	T	T	

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE CCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	ORMAL	SERVICE	ORMAL			
3.2.1.2.13.1.2	Alignment and tilt controls (1) support structure provision (2) Mechanical (3) mean error of contiguous data (4) Boresight adjustment (a) Electrical/Steerable (b) Mechanical		I I T T T T					Title
3.2.1.2.13.1.3	Antenna stability			T				
3.2.1.2.13.1.4	Polarization				T			
3.2.1.3	Data Transmission		T					
3.2.1.3.1.	Basic Data							Title
3.2.1.3.1.1.	Status information (1) Status of AZ, EL, DME/P and Back Az (2) Change of status		T TA					Title Title
3.2.1.3.2.	Auxiliary Data (1) Capability to encode 192 aux. words (2) Radiate and monitor, transmission Rate (3) Maximum use available time slot for transmission (4) Update variable auxiliary data		A TA A IA					Title
3.2.1.4.	Precision Distance Measuring Equipment (DME/P)							Title
3.2.1.4.1.	General DME/P Requirements							Lead-In

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC- TION	SITE ACCEPT.		
		SERVICE	NORMAL	SERVICE	NORMAL				
3.2.1.4.2.	DME/P equipment (1) DME/P equipment (2) Performance requirements (3) Category II to III conversion capability	I	T	I	D		I	D	Title
3.2.1.4.3.	Transponder Characteristics					I	I		Title
3.2.1.4.3.1.	General Performance								Title
3.2.1.4.3.1.1	Range (1) Measurement of slant range distances (2) Reply to DME/N and DME/P interrogation signals				A			T	D
3.2.1.4.3.1.2.	Coverage (1) Dmni -directional (2) Power density								Title
3.2.1.4.3.1.3.	Transponder accuracy (1) Accuracy IAW 3.2.1.4.4.1.6.1 (2) Accuracy IAW FAA-STD-022, paragraph 3.5.4					TA		T	See 3.2.1.4.4.1:5
3.2.1.4.3.2.	Radio frequencies and polarization (1) Receive and radiate in freq. band 960 MHz to 1295 MHz (2) Interrogation and reply freq. IAW table 12 of FAA-STD-022	I	T				I	T	Title
3.2.1.4.3.3.	Channeling								
3.2.1.4.3.3.1.	DME channels				T				Title

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC- TION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.4.2.	DME/P equipment (1) DME/P equipment (2) Performance requirements (3) Category II to III conversion capability	I	T	I	D	I	D	Title
3.2.1.4.3.	Transponder Characteristics					I	I	Title
3.2.1.4.3.1.	General Performance							Title
3.2.1.4.3.1.1	Range (1) Measurement of slant range distances (2) Reply to DME/N and DME/P interrogation signals			A	T	I	T	D
3.2.1.4.3.1.2.	Coverage (1) Dmni -directional (2) Power density							Title
3.2.1.4.3.1.3.	Transponder accuracy (1) Accuracy IAW 3.2.1.4.4.1.6.1 (2) Accuracy IAW FAA-STD-022, paragraph 3.5.4	I	T			I	T	See 3.2.1.4.4.1.5 Title
3.2.1.4.3.2.	Radio frequencies and polarization (1) Receive and radiate in freq. band 960 MHz to 1295 MHz (2) Interrogation and reply freq. IAW table 12 of FAA-STD-022	I		T	A		D	Title
3.2.1.4.3.3.	Channeling	I	I					Title
3.2.1.4.3.3.1.	DME channels			T				

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE CCEPT.		
		SERVICE	NORMAL	SERVICE	NORMAL				
3.2.1.4.4.1.2.5	Pulse Pedestal (1) amplitude (2) leading edge of the pulse bounding (3) excursions of leading edge		TA	T		T		Title	
3.2.1.4.4.1.3	RF pulse signal spectrum (1) Spectrum (2) Effective radiated power (3) Lobe of spectrum's amplitude			T		T		Title	
				T					
				T					
3.2.1.4.4.1.3.1	Out-of-band spurious output			T				Title	
3.2.1.4.4.1.3.2	In-band spurious output (1) RF output level (2) Interval between the pulses of each pair			T					
				T					
3.2.1.4.4.1.3.3	Harmonics			T				Title	
3.2.1.4.4.1.4	Polarization								
3.2.1.4.4.1.5	Power densities (1) Peak Mower densities (a) -89 dBW/m² at ranges from 7 NM to 22 NM (b) -75 dBW/m² out to 7 NM (c) -70 dBW/m² at MLS approach reference datum (d) -79 dBW/m² from 8 ft. to 2,000 ft.			T		T			Title Lead-In
					T		T		
					T		T		
					T		T		
					T		T		

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE CCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3. 2. 1. 4. 4. 1. 2. 5	Pulse Pedestal (1) amplitude (2) leading edge of the pulse bounding (3) excursions of leading edge		TA	T		T		Title
3. 2. 1. 4. 4. 1. 3	RF pulse signal spectrum (1) Spectrum (2) Effective radiated power (3) Lobe of spectrum's amplitude			T		T		Title
	3.2.1.4.4.1.3.1	Out-of-band spurious output		T				Title
		3. 2. 1. 4. 4. 1. 3. 2		In-band spurious output (1) RF output level (2) Interval between the pulses of each pair	T			
3. 2. 1. 4. 4. 1. 3. 3		Harmonics		T				
3. 2. 1. 4. 4. 1. 4.	Polarization						Title Lead-In	
3.2.1.4.4.1.5.	Power densities (1) Peak Mower densities (a) -89 dBW/m² at ranges from 7 NM to 22 NM (b) -75 dBW/m² out to 7 NM (c) -70 dBW/m² at MLS approach reference datum (d) -79 dBW/m² from 8 ft. to 2,000 ft.			T		T		
				T		T		
				T		T		
				T		T		
				T		T		
				T		T		

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION		SITE CCEPT.
		SERVICE	ORMAL	SERVICE	ORMAL			
3.2.1.4.4.1.6.2	Morse Code Identification							Title
	(1) ID signal constant transmission rate			T		T		
	(2) Three letter identifier		A			T		
	(3) ID characteristics & letter rate			T		T		
	(a) Dot design center time duration			T		T		
	(i) Time duration tolerance			T		T		
	(b) Dash duration			T		T		
	(c) Duration between dots/dashes			T		T		
	(d) Duration between letters/numerals			T		T		
	(e) Duration of ID code			T		T		
	(4) Basic ID cycle			T		T		
	(a) Co-location with ILS			T		T		
	(i) Loss of ILS localizer			T		T		
	(ii) Return of ILS localizer			T		T		
3.2.1.4.4.1.6.3	Squitter outputs							
	(1) Automatically generated and control		T					
	(2) Transmission Rate		T					
	(3) Transponder receiver internal noise		A					
	(4) Nonuniform			T				
	(5) No squitter added when output transmission rate preset rate			T				

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION		SITE CCEPT.
		SERVICE	ORMAL	SERVICE	ORMAL			
3.2.1.4.4.1.6.2	Morse Code Identification							Title
	(1) ID signal constant transmission rate			T		T		
	(2) Three letter identifier		A			T		
	(3) ID characteristics & letter rate			T		T		
	(a) Dot design center time duration			T		T		
	(i) Time duration tolerance			T		T		
	(b) Dash duration			T		T		
	(c) Duration between dots/dashes			T		T		
	(d) Duration between letters/numerals			T		T		
	(e) Duration of ID code			T		T		
	(4) Basic ID cycle			T		T		
	(a) Co-location with ILS			T		T		
	(i) Loss of ILS localizer			T		T		
	(ii) Return of ILS localizer			T		T		
3.2.1.4.4.1.6.3	Squitter outputs							
	(1) Automatically generated and control		T					
	(2) Transmission Rate		T					
	(3) Transponder receiver internal noise		A					
	(4) Nonuniform			T				
	(5) No squitter added when output transmission rate preset rate			T				

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRWUC-ION		SITE ACCEPT.
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.4.4.2.1.2	Sensitivity variation with pulse coding (1) Threshold sensitivity value (2) Interrogation rejection	T		T		T		Title
3.2.1.4.4.2.1.3	Sensitivity variation with frequency			T	I	I	T	
3.2.1.4.4.2.1.4	Sensitivity variation with interrogation loading (1) Threshold sensitivity for 1 reference interrogator (2) Sensitivity measurement conditions (3) Threshold sensitivity						T	
3.2.1.4.4.2.1.5	Sensitivity variation with adjacent channel interrogations (1) Transponder threshold sensitivity (2) Cross channel interrogation rejection	T				T		Title
3.2.1.4.4.2.1.6	Sensitivity variation with closely spaced pulses (1) Transponder threshold sensitivity (2) Time of occurrence measurement (3) Single pulse amplitude (3) Time of occurrence	T				T		Title
3.2.1.4.4.2.2.	Reply efficiency variations		T T T T					
3.2.1.4.4.2.2.1	Random single pulses				T			Title

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS		
		DESIGN		TYPE		PRWUC-ION		SITE ACCEPT.	
									SERVICE
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRWUC-ION	SITE ACCEPT.	REMARKS	
3.2.1.4.4.2.1.2	Sensitivity variation with pulse coding (1) Threshold sensitivity value (2) Interrogation rejection	T		T		T		Title	
3.2.1.4.4.2.1.3	Sensitivity variation with frequency			T		T			
3.2.1.4.4.2.1.4	Sensitivity variation with interrogation loading (1) Threshold sensitivity for 1 reference interrogator (2) Sensitivity measurement conditions (3) Threshold sensitivity					T			T
3.2.1.4.4.2.1.5	Sensitivity variation with adjacent channel interrogations (1) Transponder threshold sensitivity (2) Cross channel interrogation rejection	T				T		Lead-In	
3.2.1.4.4.2.1.6	Sensitivity variation with closely spaced pulses (1) Transponder threshold sensitivity (2) Time of occurrence measurement (3) Single pulse amplitude (3) Time of occurrence	T				T		T	Title
3.2.1.4.4.2.2.	Reply efficiency variations			T T T T					
3.2.1.4.4.2.2.1	Random single pulses				T			Title	

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRWUC-TION		SITE ACCEPT.
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.4.4.3.1.	Transponder receiver bandwidth (1) 1A mode, 12 dB bandwidth (2) FA mode, 12 dB bandwidth		A A	T T		T T		Title
3.2.1.4.4.3.2.	Warm-up times (1) Start-up with facility power (2) Start-up without facility power		T T A					Title
3.2.1.4.4.3.3.	Output protection							Title
3.2.1.4.4.3.4.	Antenna (1) Single antenna (2) Maintenance provisions	T D						Title
3.2.1.4.5	Station power							Title
3.2.1.4.5.1	Site and equipment power		T				D	
3.2.1.4.5.2	Battery supply (1) Azimuth or DME/P batteries (2) DME/P batteries IAW 3.2.1.1.10.2		I I					See 3.2.1.1.10.2
3.2.1.4.5.3	Power supply		I					
3.2.1.4.5.4	Voltage regulators							See 3.2.1.1.10.4
3.2.1.4.5.5	Convenience outlets							See 3.2.1.1.10.5
3.2.1.5.	Remote control, status and monitoring requirements							Title

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD							REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.		
		SERVICE	NORMAL	SERVICE	NORMAL				
3.2.1.5.1.	Remote control and Status unit (RCSU) (1) RCSU components (2) RCSU general capabilities	I							Title
3.2.1.5.1.1.	RCSU Electronics Unit	D				D	D		Title
3.2.1.5.1.1.1.	Interface requirements	S							Title
3.2.1.5.1.1.2.	Physical requirements (1) Visual front panel indications (2) EIA-232 connectors (3) Fiber optic SMA connectors (4) Mount in 19" rack (5) Four units in one panel (6) Height 14.0" and depth 20" (7) Electrical power requirements (8) Type of power source			D I I		D	D		
3.2.1.5.1.2.	RCSU Panel	I							Title
3.2.1.5.1.2.1.	Control and display features (1) Visual system indicators (2) Equipment status indications (a) Visual indication suppression (3) Aural indications (4) Controls for switching equipment on and off (5) Restart capability	D D D D D				D D D D D	D D D D D		Title Title Included in System Test Included in System Test Included in System Test Included in System Test Included in System Test

VERIFICATION METHODS: I=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, C=CONTRACTOR DETERMINES METHOD OF VERIFICATION, L=REQUIREMENT SATISFIED BY LOWER LEVEL REQUIREMENT, S=REDUNDANT REQUIREMENT, N/A=NOT APPLICABLE

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD							REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.		
		SERVICE	NORMAL	SERVICE	NORMAL				
3.2.1.5.1.	Remote control and Status unit (RCSU) (1) RCSU components (2) RCSU general capabilities	I						Title	
3.2.1.5.1.1.	RCSU Electronics Unit	D				D	D	Title	
3.2.1.5.1.1.1.	Interface requirements	S						Title	
3.2.1.5.1.1.2.	Physical requirements (1) Visual front panel indications (2) EIA-232 connectors (3) Fiber optic SMA connectors (4) Mount in 19" rack (5) Four units in one panel (6) Height 14.0" and depth 20" (7) Electrical power requirements (8) Type of power source			D I I		D	D		
3.2.1.5.1.2.	RCSU Panel	I						Title	
3.2.1.5.1.2.1.	Control and display features (1) Visual system indicators (2) Equipment status indications (a) Visual indication suppression (3) Aural indications (4) Controls for switching equipment on and off (5) Restart capability	D D D D D				D D D D D	D D D D D	Title Title Included in System Test Included in System Test Included in System Test Included in System Test Included in System Test	

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.5.1.2.2.	(d) No aural indication in maintenance control	D				D	D	Included in System Test
	(17) Intensity controls	D				D	D	Included in System Test
	(18) Power ON/OFF switch	D				D	D	Included in System Test
	(19) Panel test	D				D	D	Included in System Test
	(20) Features available in operational control	D				D	D	Included in System Test
	Physical requirements		I					Title
	(1) Completely enclosed		I					
	(2) Front panel maximum width		I					
	(3) Mounting options		I					
	(4) Electrical power requirements		T					
3.2.1.5.2.	(5) Type of power source		T					
	(6) Rack mounted		I					
	Remote Status Unit (RSU)	D				D	D	
	Interface requirements	T				D	D	
	Display features	L				L	L	
3.2.1.5.2.1.	(1) Visual indicators	D				D	D	Included in System Test
	(2) Separate status indications	D				D	D	Included in System Test
	(a) Visual indicator suppression	D				D	D	Included in System Test
	(3) Aural indications	D				D	D	Included in System Test
	(4) CAT I/II/III status	D				D	D	Included in System Test
	(a) Aural indication of state change	D				D	D	Included in System Test
	(5) Display of the runway selected	D				D	D	Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.5.1.2.2.	(d) No aural indication in maintenance control	D				D	D	Included in System Test
	(17) Intensity controls	D				D	D	Included in System Test
	(18) Power ON/OFF switch	D				D	D	Included in System Test
	(19) Panel test	D				D	D	Included in System Test
	(20) Features available in operational control	D				D	D	Included in System Test
	Physical requirements		I					Title
	(1) Completely enclosed		I					
	(2) Front panel maximum width		I					
	(3) Mounting options		I					
	(4) Electrical power requirements		T					
3.2.1.5.2.	(5) Type of power source		T					
	(6) Rack mounted		I					
	Remote Status Unit (RSU)	D				D	D	
	Interface requirements	T				D	D	
	Display features	L				L	L	
3.2.1.5.2.1.	(1) Visual indicators	D				D	D	Included in System Test
	(2) Separate status indications							
	(a) Visual indicator suppression	D				D	D	Included in System Test
	(3) Aural indications	D				D	D	Included in System Test
	(4) CAT I/II/III status	D				D	D	Included in System Test
	(a) Aural indication of state change	D				D	D	Included in System Test
	(5) Display of the runway selected	D				D	D	Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	BITE CCEPT.	
		ERVICE	ORMAL	ERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.6.1.1.1.	Integrity alarms (1) Response to integrity alarms (a) Cause radiation to cease (b) Complete actions of 3.2.1.6.1.1.1 or .2 (c) Complete control actions uithin 1 second (2) Stop radiation only when monitor is in normal				L T T T T			Title Lead-in
3.2.1.6.1.1.1.1.	Standby status (1) Switchover to secondary equipment (2) Aural and visual alarms (3) Communicate failed parameter to RHS				L D T D D	L D T D D	D D D D D	Lead-in
3.2.1.6.1.1.1.2.	Non-standby status (1) Automatic restart (a) Successful restart (b) Restart cancellation (2) Aural and visual alarms (3) Communicate failed parameter to RMS				D T T D T D	D T T D T D	D D D D D D	
3.2.1.6.1.1.2.	Secondary alerts (1) Cause the radiation of erroneous function to cease (a) Standby status exception (2) Aural and Visual Alarms (3) Communicate failed parameter to RMS		D D T D			D D T D		Title

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
		(SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.6.1.2.	Control and display features (LCSU)	T				T	D	Title
	(1) On/Off Control for the station	T				T	D	
	(2) Equipment Restart	T				T	D	
	(3) Status indicator							
	(a) Green	D				D	D	
	(b) Yellow	D				D	D	
	(c) Red	D				D	D	
	(4) Redesignate primary switch	D				D	D	
	(5) Aural and Visual alarms	D				D	D	
	(6) Aural alarm reset switch	D				D	D	
	(7) Portable Terminal Interface	D		I		D	D	I
	(8) Features available only in Maintenance Control							
3.2.1.6.2	DME/P							Title
	(1) Inputs from the executive monitor		L					
	(2) Control and display capabilities		L					
3.2.1.6.2.1.	Responses to executive monitor inputs				L	L	L	Lead-in
3.2.1.6.2.1.1.	Integrity alarms							Title
	(1) Cause radiation to cease				T	T	D	
	(2) Cease radiation only when monitor is normal				T	T	D	
3.2.1.6.2.1.1.1.	Standby status							Title
	(1) Switchover to secondary equipment				D	D	D	
	(2) Aural and visual alarms				T	T	T	
	(3) Provide cause of integrity alarm to RMS				D	D	D	

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS	
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.		
		(SERVICE	NORMAL	SERVICE	NORMAL				
PARAGRAPH NO.	TITLE								
3.2.1.6.1.2.	Control and display features (LCSU) (1) On/Off Control for the station (2) Equipment Restart (3) Status indicator (a) Green (b) Yellow (c) Red (4) Redesignate primary switch (5) Aural and Visual alarms (6) Aural alarm reset switch (7) Portable Terminal Interface (8) Features available only in Maintenance Control	T T T D D D D D D D D				T T T D D D D D D D D	D D D D D D D D D D D	Title	
3.2.1.6.2	DME/P								Title
3.2.1.6.2.1.	Responses to executive monitor inputs				L	L	L		
3.2.1.6.2.1.1.	Integrity alarms (1) Cause radiation to cease (2) Cease radiation only when monitor is normal					T T	D D		Lead-in Title
3.2.1.6.2.1.1.1.	Standby status (1) Switchover to secondary equipment (2) Aural and visual alarms (3) Provide cause of integrity alarm to RMS						D T D	Title	

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC- TION		SITE ACCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
3. 2. 1. 6. 3. 2.	Control modes							Title
	(1) operational and maintenance control		D			D	D	Included in System Test
	(2) operational control		D			D	D	Included in System Test
	(a) normal mode		D			D	D	Included in System Test
	(3) maintenance control		D			D	D	Included in System Test
	(a) test mode		T			T	D	Included in System Test
	(b) status bits		T			T	D	Included in System Test
	(i) Parameters modified status bits		T			T	D	Included in System Test
	(c) test identifier		T			T	D	Included in System Test
	(i) Parameters modified for unmonitored parameters		T			T	D	Included in System Test
3. 2. 1. 6. 3. 3.	Control mastership		T			D	D	Title
3. 2. 1. 6. 3. 4.	Coordination principles and procedures							Title
	(1) Requests for maintenance control		D			D	D	Included in System Test
	(2) Requests to gain control annunciated		T			D	D	Included in System Test
	(3) Control from a single request		D			D	D	Included in System Test
	(4) Control of multiple equipments		D			D	D	Included in System Test
	(5) Option to grant or deny control mastership		T			D	D	Included in System Test
	(6) Control mastership automatically granted		D			D	D	Included in System Test
	(7) Maintenance control at PMDT with cm. failure		D			D	D	Included in System Test
	(8) Operational control auto. restored to RCSU		D			D	D	Included in System Test
	(9) Equipment not under operational control		D			D	0	Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC- TION		SITE ACCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
3. 2. 1. 6. 3. 2.	Control modes							Title
	(1) operational and maintenance control		D			D	D	Included in System Test
	(2) operational control		D			D	D	Included in System Test
	(a) normal mode		D			D	D	Included in System Test
	(3) maintenance control		D			D	D	Included in System Test
	(a) test mode		T			T	D	Included in System Test
	(b) status bits		T			T	D	Included in System Test
	(i) Parameters modified status bits		T			T	D	Included in System Test
	(c) test identifier		T			T	D	Included in System Test
	(i) Parameters modified for unmonitored parameters		T			T	D	Included in System Test
3. 2. 1. 6. 3. 3.	Control mastership		T			D	D	Title
3. 2. 1. 6. 3. 4.	Coordination principles and procedures							Title
	(1) Requests for maintenance control		D			D	D	Included in System Test
	(2) Requests to gain control annunciated		T			D	D	Included in System Test
	(3) Control from a single request		D			D	D	Included in System Test
	(4) Control of multiple equipments		D			D	D	Included in System Test
	(5) Option to grant or deny control mastership		T			D	D	Included in System Test
	(6) Control mastership automatically granted		D			D	D	Included in System Test
	(7) Maintenance control at PMDT with cm. failure		D			D	D	Included in System Test
	(8) Operational control auto. restored to RCSU		D			D	D	Included in System Test
	(9) Equipment not under operational control		D			D	0	Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS. PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC- TION		SITE ACCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
3. 2. 1. 6. 3. 5. 3.	Normal Azimuth Configuration No. 3 (1) Not radiating (2) One or more integrity alarms in sec. equip. (3) Secondary equipment selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 4.	Normal Azimuth Configuration No. 4 (1) Not radiating (2) Primary equipment selected (3) Commands		I		T T T			Title Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 5.	Normal Azimuth Configuration No. 5 (1) Not radiating (2) Secondary equipment selected (3) Commands				T T T			Title Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS. PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC-TION		SITE ACCEPT.
		SERVICE	NORMAL/SERVICE	NORMAL				
3. 2. 1. 6. 3. 5. 3.	Normal Azimuth Configuration No. 3 (1) Not radiating (2) One or more integrity alarms in sec. equip. (3) Secondary equipment selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 4.	Normal Azimuth Configuration No. 4 (1) Not radiating (2) Primary equipment selected (3) Commands				T T T			Title Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 5.	Normal Azimuth Configuration No. 5 (1) Not radiating (2) Secondary equipment selected (3) Commands				T T T			Title Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3. 2. 1. 6. 3. 5. 10.	Normal Back Azimuth Configuration No. 10 (1) Not radiating (2) Secondary equipment selected (3) colmlands				T T T			Title Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 11.	Normal Azimuth: Reconfigure Conf. No. 11 (1) Not radiating (2) calmlands				T T			Title Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 12.	Test Azimuth Configuration No. 12 (1) Test mode (2) Primary equipment operating (3) Switchover to the secondary (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 13.	Test Azimuth Configuration No. 13 (1) Test mode (2) Primary equipment operating (3) Monitor bypassed selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 14.	Test Azimuth Configuration No. 14 (1) Test mode (2) Secondary equipment operating (3) Failure of the secondary (4) colmlands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3. 2. 1. 6. 3. 5. 10.	Normal Back Azimuth Configuration No. 10 (1) Not radiating (2) Secondary equipment selected (3) colmlands				T T T			Title Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 11.	Normal Azimuth: Reconfigure Conf. No. 11 (1) Not radiating (2) calmlands				T T			Title Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 12.	Test Azimuth Configuration No. 12 (1) Test mode (2) Primary equipment operating (3) Switchover to the secondary (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 13.	Test Azimuth Configuration No. 13 (1) Test mode (2) Primary equipment operating (3) Monitor bypassed selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 14.	Test Azimuth Configuration No. 14 (1) Test mode (2) Secondary equipment operating (3) Failure of the secondary (4) colmlands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.6.3.5.20.	Test Azimuth Configuration No. 20 (1) Not radiating (2) Secondary equipment selected (3) Monitor bypassed selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.21.	Test Back Azimuth Configuration No. 21 (1) Test mode (2) Primary equipment operating (3) Failure of the primary (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.22.	Test Back Azimuth Configuration No. 22 (1) Test mode (2) Monitor bypassed selected (3) Primary equipment operating (4) commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.23.	Test Back Azimuth Configuration No. 23 (1) Test mode (2) Secondary equipment operating (3) Failure of the secondary (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.6.3.5.20.	Test Azimuth Configuration No. 20 (1) Not radiating (2) Secondary equipment selected (3) Monitor bypassed selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.21.	Test Back Azimuth Configuration No. 21 (1) Test mode (2) Primary equipment operating (3) Failure of the primary (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.22.	Test Back Azimuth Configuration No. 22 (1) Test mode (2) Monitor bypassed selected (3) Primary equipment operating (4) commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.23.	Test Back Azimuth Configuration No. 23 (1) Test mode (2) Secondary equipment operating (3) Failure of the secondary (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUCTION		SITE ACCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.6.3.5.28.	Test Back Azimuth Configuration No. 28 (1) Not radiating (2) Secondary equipment selected (3) commands				T T T		Title Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.29.	Test Back Azimuth Configuration No. 29 (1) Not radiating (2) Secondary equipment selected (3) Monitor bypassed selected (4) Commands				T T T T		Title Included in System Test Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.30.	Test Back Azimuth Configuration No. 30 (1) Not radiating (2) commands		I	I	T T		Title Included in System Test Included in System Test	
3.2.1.6.3.5.31.	Normal Elevation Configuration No. 1 (1) Normal mode (2) Primary equipment operating (3) Suitchover to secondary equipment (4) commands				T T T T		Title Included in System Test Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.32.	Normal Elevation Configuration No. 2 (1) Normal mode (2) Secondary equipment operating (3) Failure of the secondary (4) Commands				T T T T		Title Included in System Test Included in System Test Included in System Test Included in System Test	

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUCTION		SITE ACCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.6.3.5.28.	Test Back Azimuth Configuration No. 28 (1) Not radiating (2) Secondary equipment selected (3) commands				T T T			Title Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.29.	Test Back Azimuth Configuration No. 29 (1) Not radiating (2) Secondary equipment selected (3) Monitor bypassed selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.30.	Test Back Azimuth Configuration No. 30 (1) Not radiating (2) commands	I	I		T T			Title Included in System Test Included in System Test
3.2.1.6.3.5.31.	Normal Elevation Configuration No. 1 (1) Normal mode (2) Primary equipment operating (3) Suitchover to secondary equipment (4) commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.32.	Normal Elevation Configuration No. 2 (1) Normal mode (2) Secondary equipment operating (3) Failure of the secondary (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION	SITE CCEPT.	
		SERVICE	ORMAL	SERVICE	ORMAL			
3.2.1.6.3.5.38.	Normal Offline Elevation Configuration No. 8 (1) Not radiating (2) Secondary equipment selected (3) colmlands				T T T			Title Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.39.	Normal Elevation Reconfigure No. 9 (1) Not radiating (2) Commands				T T			Title Included in System Test Included in System Test
3.2.1.6.3.5.40.	Test Approach Elevation Configuration No. 10 (1) Test mode (2) Primary equipment operating (3) Failure of the primary (4) cmnds				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.41.	Test Approach Elevation Configuration No. 11 (1) Test mode (2) Primary equipment operating (3) Monitor bypass selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.42.	Test Approach Elevation Configuration No. 12 (1) Test mode (2) Failure of the secondary (3) cmnds				T T T			Title Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.6.3.5.43.	Test Approach Elevation Configuration No. 13							Title
	(1) Test mode				T			Included in System Test
	(2) Secondary equipment operating				T			Included in System Test
	(3) Monitor bypass selected				T			Included in System Test
3.2.1.6.3.5.44.	(4) Commands				T			Included in System Test
	Test Approach Elevation Configuration No. 14							Title
	(1) Not radiating				T			Included in System Test
	(2) One or more integrity alarms				T			Included in System Test
3.2.1.6.3.5.45.	(3) Secondary equipment selected				T			Included in System Test
	(4) Commands				T			Included in System Test
	Test Approach Elevation Configuration No. 15							Title
	(1) Not radiating				T			Included in System Test
3.2.1.6.3.5.46.	(2) Primary equipment selected				T			Included in System Test
	(3) colmlands				T			Included in System Test
	Test Approach Elevation Configuration No. 16							Title
	(1) Not radiating				T			Included in System Test
3.2.1.6-3.5.46.	(2) Primary equipment selected				T			Included in System Test
	(3) Monitor bypassed selected				T			Included in System Test
	(4) Commands				T			Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRODUCTION	SITE ACCEPT.	REMARKS
3.2.1.6.3.5.43.	Test Approach Elevation Configuration No. 13							Title
	(1) Test mode				T			Included in System Test
	(2) Secondary equipment operating				T			Included in System Test
	(3) Monitor bypass selected				T			Included in System Test
	(4) Commands				T			Included in System Test
3.2.1.6.3.5.44.	Test Approach Elevation Configuration No. 14							Title
	(1) Not radiating				T			Included in System Test
	(2) One or more integrity alarms				T			Included in System Test
	(3) Secondary equipment selected				T			Included in System Test
	(4) Commands				T			Included in System Test
3.2.1.6.3.5.45.	Test Approach Elevation Configuration No. 15							Title
	(1) Not radiating				T			Included in System Test
	(2) Primary equipment selected				T			Included in System Test
	(3) colmlands				T			Included in System Test
3.2.1.6-3.5.46.	Test Approach Elevation Configuration No. 16							Title
	(1) Not radiating				T			Included in System Test
	(2) Primary equipment selected				T			Included in System Test
	(3) Monitor bypassed selected				T			Included in System Test
	(4) Commands				T			Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRODUC-TION	SITE ACCEPT.	REMARKS
3. 2. 1. 6. 3. 5. 52.	Test Offline Elevation Configuration No. 22 (1) Not radiating (2) Secondary equipment selected (3) Commands	I	I		T T T			Title Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 53.	Test Offline Elevation Configuration No. 23 (1) Not radiating (2) Secondary equipment selected (3) Monitor bypassed selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 54.	Test Approach Elevation: Reconfigure Configuration No. 24 (1) Not radiating (2) Commands				T T			Title Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 55.	Normal Approach DME/P Configuration No. 1 (1) Normal mode (2) Primary equipment operating (3) Switchover to the secondary equipment (4) Failure of either IA or FA functions (5) Commands				T T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3. 2. 1. 6. 3. 5. 52.	Test Offline Elevation Configuration No. 22 (1) Not radiating (2) Secondary equipment selected (3) Commands	I	I		T T T			Title Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 53.	Test Offline Elevation Configuration No. 23 (1) Not radiating (2) Secondary equipment selected (3) Monitor bypassed selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 54.	Test Approach Elevation: Reconfigure Configuration No. 24 (1) Not radiating (2) Commands				T T			Title Included in System Test Included in System Test
3. 2. 1. 6. 3. 5. 55.	Normal Approach DME/P Configuration No. 1 (1) Normal mode (2) Primary equipment operating (3) Switchover to the secondary equipment (4) Failure of either IA or FA functions (5) Commands				T T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test Included in System Test

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FAA-E-2721B
August 30, 1990

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUC-TION		SITE ACCEPT.
		SERVI CE	NORMAL	SERVI CE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.6.3.5.60.	Normal Approach DME/P Configuration No. 6 (1) Not radiating (2) No integrity alarms (3) Secondary equipment selected (4) Commands				T T T T		Title. Included in System Test Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.61.	Normal Offline DME/P Configuration No. 7 (1) Not radiating (2) One or more integrity alarms (3) Secondary equipment selected (4) c m n d s				T T T T		Title Included in System Test Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.62.	Normal Offline DME/P Configuration No. 8 (1) Not radiating (2) Primary equipment selected (3) c m n d s				T T T		Title Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.63.	Normal Offline DME/P Configuration No. 9 (1) Not radiating (2) No integrity alarms (3) Secondary equipment selected (4) cormlands				T T T T		Title Included in System Test Included in System Test Included in System Test Included in System Test	

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FAA-E-2721B
August 30, 1990

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUC-TION		SITE ACCEPT.
		SERVI CE	NORMAL	SERVI CE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.6.3.5.60.	Normal Approach DME/P Configuration No. 6 (1) Not radiating (2) No integrity alarms (3) Secondary equipment selected (4) Commands				T T T T		Title. Included in System Test Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.61.	Normal Offline DME/P Configuration No. 7 (1) Not radiating (2) One or more integrity alarms (3) Secondary equipment selected (4) c m n d s				T T T T		Title Included in System Test Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.62.	Normal Offline DME/P Configuration No. 8 (1) Not radiating (2) Primary equipment selected (3) c m n d s				T T T		Title Included in System Test Included in System Test Included in System Test	
3.2.1.6.3.5.63.	Normal Offline DME/P Configuration No. 9 (1) Not radiating (2) No integrity alarms (3) Secondary equipment selected (4) cormlands				T T T T		Title Included in System Test Included in System Test Included in System Test Included in System Test	

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.6.3.5.68.	Test Approach DME/P Configuration No. 14							Title
	(1) Test mode				T		I	Included in System Test
	(2) Monitor bypass selected				T			Included in System Test
	(3) Secondary equipment selected				T			Included in System Test
3.2.1.6.3.5.69.	(4) Commands				T		i	Included in System Test
	Test Approach DME/P Configuration No. 15							Title
	(1) Test mode, IA only				T			Included in System Test
	(2) One or more integrity alarms in FA function				T			Included in System Test
3.2.1.6.3.5.70.	(3) Secondary equipment operating				T			Included in System Pest
	(4) Failure results in shutdown				T			Included in System Test
	(5) Commands				T			Included in System Test
	Test Approach DME/P Configuration No. 16							Title
3.2.1.6.3.5.71.	(1) Test mode, IA only				I T			Included in System Test
	(2) One or more integrity alarms in FA function				T			Included in System Test
	(3) Monitor bypass selected				T			Included in System Test
	(4) Secondary equipment operating				T			Included in System Test
3.2.1.6.3.5.72.	(5) Commands				T			Included in System Test
	Test Approach DME/P Configuration No. 17							Title
	(1) Not radiating				T			Included in System Test
	(2) Integrity alarms				T			Included in System Test
3.2.1.6.3.5.73.	(3) Secondary equipment selected				T			Included in System Test
	(4) Commands				T			Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.2.1.6.3.5.68.	Test Approach DME/P Configuration No. 14				T		I	Title
	(1) Test mode				T			Included in System Test
	(2) Monitor bypass selected				T			Included in System Test
	(3) Secondary equipment selected				T			Included in System Test
	(4) Commands				T		i	Included in System Test
3.2.1.6.3.5.69.	Test Approach DME/P Configuration No. 15							Title
	(1) Test mode, IA only				T			Included in System Test
	(2) One or more integrity alarms in FA function				T			Included in System Test
	(3) Secondary equipment operating				T			Included in System Test
	(4) Failure results in shutdown				T			Included in System Test
	(5) Commands				T			Included in System Test
3.2.1.6.3.5.70.	Test Approach DME/P Configuration No. 16							Title
	(1) Test mode, IA only				T			Included in System Test
	(2) One or more integrity alarms in FA function				T			Included in System Test
	(3) Monitor bypass selected				T			Included in System Test
	(4) Secondary equipment operating				T			Included in System Test
	(5) Commands				T			Included in System Test
3.2.1.6.3.5.71.	Test Approach DME/P Configuration No. 17							Title
	(1) Not radiating				T			Included in System Test
	(2) Integrity alarms				T			Included in System Test
	(3) Secondary equipment selected				T			Included in System Test
	(4) Commands				T			Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRODUCTION	SITE ACCEPT.	REMARKS
3.2.1.6.3.5.77.	Test Offline DME/P Configuration No. 23 (1) Not radiating (2) Integrity alarms (3) Primary equipment selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.78.	Test Offline DME/P Configuration No. 24 (1) Not radiating (2) Monitor bypass selected (3) Commands				T T T			Title Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.79.	Test Offline DME/P Configuration No. 25 (1) Not radiating (2) Integrity alarms (3) Secondary equipment selected (4) Commands				T T T T			Title Included in System Test Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.80.	Test Offline DME/P Configuration No.26 (1) Not radiating (2) Monitor bypass selected (3) Commands				T T T			Title Included in System Test Included in System Test Included in System Test
3.2.1.6.3.5.81.	Test DME/P Reconfigure, Configuration No. 27 (1) Not radiating (2) Commands				T T			Title Included in System Test Included in System Test

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3. 2. 1. 6. 3. 5. 82.	No REU State							Title
	(1) Exist for every configuration				T			Included in System Test
	(2) Equipment is in operational control				I			Included in System Test
	(3) Commands except runway reconfigure				T			Included in System Test
	(4) Maintenance control				T			Included in System Test
	(5) Equipment is in maintenance control				I			Included in System Test
3. 2. 1. 6. 4	Equipment Status Verification							Title
3. 2. 1. 6. 4. 1	End to End Integrity Check							Title
	(1) Capability for equipment				D	D	D	
	(2) Scope of check		A		D			
	(3) Checks via PMDT and RMMS				D	D	D	
	(4) Control coordination				D	D	D	
	(5) Secondary Equipment Verification				D	D	D	
	(6) Alarm resulting from failed check				T	D		
	(7) Information to RMS				D	D	D	
3. 2. 1. 6. 4. 2	Automatic Integrity Check							Title
	(1) Identity Malfunction				T	D	D	
	(a) Parameters checked	A			T			
	(b) Check not changing radiation				T			
	(c) Alarm resulting form failed check				T	D		

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRODUCTION	SITE ACCEPT.	REMARKS
3. 2. 1. 6. 3. 5. 82.	No REU State							Title
	(1) Exist for every configuration				T			Included in System Test
	(2) Equipment is in operational control				T			Included in System Test
	(3) Commands except runway reconfigure				T			Included in System Test
	(4) Maintenance control				T			Included in System Test
	(5) Equipment is in maintenance control				T			Included in System Test
3. 2. 1. 6. 4	Equipment Status Verification							Title
3. 2. 1. 6. 4. 1	End to End Integrity Check							Title
	(1) Capability for equipment				D	D	D	
	(2) Scope of check		A		D			
	(3) Checks via PMDT and RMMS				D	D	D	
	(4) Control coordination				D	D	D	
	(5) Secondary Equipment Verification				D	D	D	
	(6) Alarm resulting from failed check				T	D		
	(7) Information to RMS				D	D	D	
3. 2. 1. 6. 4. 2	Automatic Integrity Check							Title
	(1) Identity Malfunction				T	D	D	
	(a) Parameters checked	A			T			
	(b) Check not changing radiation				T			
	(c) Alarm resulting form failed check				T	D		

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.7.2.1.	Executive Monitor General Requirements (1) Integrity alarms to LCSU and RMS (2) Detection of error affecting performance (3) Period of erroneous guidance do not exceed 1 sec (4) Monitor Independence		A T A	T		T D	D	Title
3.2.1.7.2.2.	Specific requirements (1) Provide test signals and sample transponder output signals (a) No more than 150 replies/second (b) Monitor additional parameters (c) Outlier window implementation (i) Raw reply delay (ii) Single reference interrogator (iii) Test of conditional requirements (iv) Outlier window width		T T T L T T T T			T T T L T T T T		Title Lead-In
3.2.1.8.	Remote monitoring subsystems (RMS)							Title
3.2.1.8.1.	Functional requirements (1) Perform maintenance functions (2) Certification via RMS (3) MPS interface		D D T			D D T	D	Title

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.7.2.1.	Executive Monitor General Requirements (1) Integrity alarms to LCSU and RMS (2) Detection of error affecting performance (3) Period of erroneous guidance do not exceed 1 sec (4) Monitor Independence		A T A	T		T D	D	Title
3.2.1.7.2.2.	Specific requirements (1) Provide test signals and sample transponder output signals (a) No more than 150 replies/second (b) Monitor additional parameters (c) Outlier window implementation (i) Raw reply delay (ii) Single reference interrogator (iii) Test of conditional requirements (iv) Outlier window width		T T T L T T T T			T T T L T T T T		Title Lead-In
3.2.1.8.	Remote monitoring subsystems (RMS)							Title
3.2.1.8.1.	Functional requirements (1) Perform maintenance functions (2) Certification via RMS (3) MPS interface		D D T			D D T	D	Title

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.8.3. 3.2.1.8.3.1.	Data processing Alarm determination (1) Alarm indications for each parameter (2) Alarm detection (3) Maintenance Warnings (4) Transient conditions (5) Maintenance control (6) Operational control (7) RMS disable intrusion for 2 minutes (8) Intrusion alarm disable after successful logon (9) Disable length of 5 minutes		L		L	I		Lead-in Title
3.2.1.8.3.2.	Return to normal determination					T		
3.2.1.8.3.3.	Change of state determination (1) Verification of change (2) Suppressing state changes (a) State changes in maintenance control (3) Fault identification					D AD D D D D T T D D D		Title
3.2.1.8.3.4.	Fault diagnostics (1) Built-in Diagnostics (2) Automatic initiation (3) Identification		A D D				D D	Title

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUC- TION	SITE CCEPT.	
		ERVICE	ORMAL	ERVICE	ORMAL			
3.2.1.8.3.5.	(4) Manual initiation (5) Single LRU (6) Isolation capability (7) Communications failure (8) No radiation during diagnostics Record of events (1) Out-of-tolerance parameters, state changes and fault diagnostic results (2) Time and date (3) Record capacity		D, A D T T		D D D D D	D	D	Title
3.2.1.8.3.6.	Timestamping							
3.2.1.8.4.	RMS/RMMS operational interface							Title
3.2.1.8.4.1.	RMS message generation (1) Timing (2) Preparation (3) Buffer size		D A D D D D		T			
3.2.1.8.4.2.	RMS Message							
3.2.1.8.4.2.1.	Alarm Message							
3.2.1.8.4.2.2.	RTN Message							
3.2.1.8.4.2.3.	State Change Message							

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	SITE CCEPT.	
PARAGRAPH NO.	TITLE	ERVICE	ORMAL	ERVICE	ORMAL			
3.2.1.8.3.5.	(4) Manual initiation		D,A D T T			D	D	Title
	(5) Single LRU							
	(6) Isolation capability							
	(7) Communications failure							
	(8) No radiation during diagnostics							
	Record of events				D			
	(1) Out-of-tolerance parameters, state changes and fault diagnostic results							
	(2) Time and date				D			
	(3) Record capacity				D			
3.2.1.8.3.6.	Timestamping				D			
3.2.1.8.4.	RMS/RMMS operational interface				D			
3.2.1.8.4.1.	RMS message generation				D			
	(1) Timing				T			
	(2) Preparation		D A D D D D					
	(3) Buffer size							
3.2.1.8.4.2.	RMS Message							
3.2.1.8.4.2.1.	Alarm Message							
3.2.1.8.4.2.2.	RTN Message							
3.2.1.8.4.2.3.	State Change Message							

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERI FICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION'	SITE ACCEPT.	
PARAGRAPH NO.	TITLE							
3. 2. 1. 8. 4. 2. 8. 1.	End-to-End Integrity Check Results (1) Generation of an SDR (2) Content of an SDR				D D			Title
3. 2. 1. 8. 4. 2. 8. 2.	Automatic Integrity Check Results (1) Generation of an SDR (2) Content of an SDR				D D			Title.
3. 2. 1. 8. 4. 2. 8. 3.	Diagnostic Results (1) Generation after diagnostics complete (2) Identification of LRU (3) Content of an SDR				D O D			Title
3.2.1.8.4.3.	Message Priority (1) Scheme (2) Multiple messages				D D			Title

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERI FICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION'	SITE ACCEPT.	
PARAGRAPH NO.	TITLE							
3. 2. 1. 8. 4. 2. 8. 1.	End-to-End Integrity Check Results (1) Generation of an SDR (2) Content of an SDR				D D			Title
3. 2. 1. 8. 4. 2. 8. 2.	Automatic Integrity Check Results (1) Generation of an SDR (2) Content of an SDR				D D			Title.
3. 2. 1. 8. 4. 2. 8. 3.	Diagnostic Results (1) Generation after diagnostics complete (2) Identification of LRU (3) Content of an SDR				D O D			Title
3.2.1.8.4.3.	Message Priority (1) Scheme (2) Multiple messages				D D			Title

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE CCEPT.	
		ERVICE	ORMAL	ERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3.2.1.8.4.5.6.	RMS security access change				D		D	Title
3.2.1.8.4.5.7.	RMS reset						D	
	(1) Reset command				D		D	
	(2) RMS actions				D		D	Title
3.2.1.8.4.5.8.	Initiate monitor bypass						D	
	(1) Initiates monitor bypass				D		D	
	(2) Automatically return monitor to normal				D		D	Title
3.2.1.8.4.5.9.	Return monitor to normal				D		D	
3.2.1.8.4.5.10.	Initiate end-to-end integrity check						D	
	(1) Command Execution				D		D	Title
	(2) Message Generation				D			
3.2.1.8.4.5.11.	Initiate diagnostics						D	
	(1) Command Execution				D		D	Title
	(2) Message Generation				D			
3.2.1.8.4.5.12.	Request maintenance control				O		D	
3.2.1.8.4.5.13	Relinquish maintenance control							Title
	(1) Command Execution				D		D	
	(2) Control Returned to RCSU				D			
3.2.1.8.4.5.14	Initiate Integrity Check							Title
	(1) Command Execution				D		D	
	(2) Generation of a Message				T			

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE CCEPT.	
PARAGRAPH NO.	TITLE							
3.2.1.8.4.5.6.	RMS security access change				D		D	Title
3.2.1.8.4.5.7.	RMS reset				D		D	
	(1) Reset command				D		D	
3.2.1.8.4.5.8.	(2) RMS actions				D		D	Title
	Initiate monitor bypass				D		D	
	(1) Initiates monitor bypass				D		D	
	(2) Automatically return monitor to normal				D		D	Title
3.2.1.8.4.5.9.	Return monitor to normal				D		D	
3.2.1.8.4.5.10.	Initiate end-to-end integrity check				D		D	
	(1) Command Execution				D		D	Title
	(2) Message Generation				D		D	
3.2.1.8.4.5.11.	Initiate diagnostics				D		D	
	(1) Command Execution				D		D	Title
	(2) Message Generation				D		D	
3.2.1.8.4.5.12.	Request maintenance control				O		D	
3.2.1.8.4.5.13	Relinquish maintenance control							Title
	(1) Command Execution				D		D	
	(2) Control Returned to RCSU				D		D	
3.2.1.8.4.5.14	Initiate Integrity Check							Title
	(1) Command Execution				D		D	
	(2) Generation of a Message				T			

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRODUCTION	SITE ACCEPT.	REMARKS
3. 2. 2. 1. 2.	Multiple design interoperability							Title
	(1) Comm. and operational compatibility				T	D		
	(2) Integral characteristics				T	D		
	(3) Inhibition				D	D		
3. 2. 2. 1. 2. 1.	Dual REU configuration							Title
	(1) Coma. implementation				T	D		
	(2) Comm. routing				T	D		
	(3) RCSU and RSU display				D	D		
	(4) Master/slave REU				T	D		
	(5) REU interface with one Az & one El station				D	D		
	(6) RCSU panel, RSUs , AUX data source, RMMS and slave REU				D	D		
	(7) Slave REU interface with one AZ & one EL station				D	D		
	(8) Slave REU- interface with master REU only				D	D		
	(9) Master/slave/stand-alone REU				D	D		
	(10) REU modifications		D					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRODUCTION	SITE ACCEPT.	REMARKS
3. 2. 2. 1. 2.	Multiple design interoperability							Title
	(1) Comm. and operational compatibility				T	D		
	(2) Integral characteristics				T	D		
	(3) Inhibition				D	D		
3. 2. 2. 1. 2. 1.	Dual REU configuration							Title
	(1) Coma. implementation				T	D		
	(2) Comm. routing				T	D		
	(3) RCSU and RSU display				D	D		
	(4) Master/slave REU				T	D		
	(5) REU interface with one Az & one El station				D	D		
	(6) RCSU panel, RSUs , AUX data source, RMMS and slave REU				D	D		
	(7) Slave REU interface with one AZ & one EL station				D	D		
	(8) Slave REU- interface with master REU only				D	D		
	(9) Master/slave/stand-alone REU				D	D		
	(10) REU modifications		D					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE CCEPT.	
PARAGRAPH NO.	TITLE	ENVIRONMENT	ORMAL	ENVIRONMENT	ORMAL	PRODUCTION	SITE CCEPT.	REMARKS
3.2.3.1.	Remote Maintenance Monitoring System (RMMS) Communications Interface							Title
	(1) Via EIA-232 comm. link				T		D	
	(2) Link ports				T			
	(3) Coding and link protocol				T			
3.2.3.1.1	RMMS EIA-232 port (characteristics)							Title
	(1) Serial data interchange interface functional capabilities				T			
	(a) Signal conversion equipment				T			
	(b) Capability to select interchange sync				T			
	(2) Nonsynchronous serial data interchange				T			
	(a) Selectable protocols				T			
	(3) Standard interface types				T			
	(4) Selectable port configuration				T			
	(5) Interface connectors		I					
	(6) Connector-to-Connector fasteners		I					
	(7) Selectable Send or Receive clocks				T			
3.2.3.2.	Auxiliary data word communications							Title
	(1) REU contain EIA-232 port				D		D	
	(2) Updating				T		D	
	(3) Update of auxiliary words time (5 second)				T			

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION		SITE CCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
	(4) EIA-232 port characteristics (a) Selectable synchronous/non-synchronous (b) Selectable as DTE/DCE (c) Standard interface types (d) Sense and auto match parity and baud rate (e) Connectors for DTE (f) Implement (ASCII) code and additional controls		L		T T I T I I			Lead-In
3.2.3.3.	Portable Maintenance Data Terminal (PMDT)		L					Title
3.2.3.3.1.	PMDT Operation							Title
	(1) Communication capability				D		D	
	(2) command				D		D	
	(3) Display capability				D		D	
	(4) Receive and display control messages				D		D	
3.2.3.3.2.	RMS/Portable Terminal Physical Interface							Title
	(1) MLS equipment provide an EIA-232 port					T		
	(2) Port characteristics		L					Lead-in
	(a) Selectable synchronous/non-synchronous				D			
	(b) Selectable as either a DTE or a DCE				T			
	(c) Standard interface types				D			
	(d) Automatic sense & match parity & baud rate				T			
	(e) Connectors for DTE				T			

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION	SITE CCEPT.		
		SERVICE	NORMAL	SERVICE	NORMAL				
3.2.3.3. 3.2.3.3.1. 3.2.3.3.2.	(4) EIA-232 port characteristics (a) Selectable synchronous/non-synchronous (b) Selectable as DTE/DCE (c) Standard interface types (d) Sense and auto match parity and baud rate (e) Connectors for DTE (f) Implement (ASCII) code and additional controls		L		T T I T I I	T	D D D D	Lead-In	
	Portable Maintenance Data Terminal (PMDT) PMDT Operation		L						Title Title
	(1) Communication capability (2) command (3) Display capability (4) Receive and display control messages				D D D D				
	RMS/Portable Terminal Physical Interface (1) MLS equipment provide an EIA-232 port (2) Port characteristics (a) Selectable synchronous/non-synchronous (b) Selectable as either a DTE or a DCE (c) Standard interface types (d) Automatic sense & match parity & baud rate (e) Connectors for DTE		L		D T D T T				Title Lead-in

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE							
3.2.5.1.2.	Switching devices							Title,
	(1) Automatic switches		A					
	(2) Manual switches		A					
3.2.5.1.5.	Category II and III equipment							Title
3.2.5.1.5.1.	Category II equipment							Title
3.2.5.1.5.1.1.	Category II continuity of service							Title
	(1) Continuity of Service		A					
	(2) Calculation		A					
3.2.5.1.5.1.2.	Category II integrity							Title
	(1) Integrity of equip. intended for Cat. II ops		A					
	(2) Time interval over which integrity applies		A					
3.2.5.1.5.2.	Category III equipment							Title
3.2.5.1.5.2.1.	Category III continuity of service							Title
	(1) Continuity of Service		A					
	(2) Continuity of service calculations		A					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3.2.5.1.2.	Switching devices							Title,
	(1) Automatic switches		A					
	(2) Manual switches		A					
3.2.5.1.5.	Category II and III equipment							Title
3.2.5.1.5.1.	Category II equipment							Title
3.2.5.1.5.1.1.	Category II continuity of service							Title
	(1) Continuity of Service		A					
	(2) Calculation		A					
3.2.5.1.5.1.2.	Category II integrity							Title
	(1) Integrity of equip. intended for Cat. II ops		A					
	(2) Time interval over which integrity applies		A					
3.2.5.1.5.2.	Category III equipment							Title
3.2.5.1.5.2.1.	Category III continuity of service							Title
	(1) Continuity of Service		A					
	(2) Continuity of service calculations		A					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REVIEWER'S PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCT ION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL	PRODUCT ION	SITE ACCEPT.	REMARKS
3.2.5.2.1.	Corrective maintenance							Title
	(1) MTR		D					
	(2) Execution time for auto. initiated diagnostics		I					
3.2.5.2.1.1.	The process							Lead-In
	(1) Requirements		D					
3.2.5.2.2.	Bench repair		DA					
3.2.5.2.3.	Mean preventive maintenance time		DA					
3.2.6.	Environmental conditions							Title
3.2.6.1.	Natural environment							Title
3.2.6.1.1.	General							Title
	(1) Environment I			T				
	(2) Environment III			T				
	(a) Use of environmental controls			D				
3.2.6.1.2.	Antenna radomes							Title
3.2.6.1.2.1	Radome deicers							Title
	(1) Automatic operation		D					
	(2) Icing conditions		D					
	(3) Requirements of FAA-STD-022		T					
3.2.6.1.2.2.	Non-wetting surface							Title
	(1) Prevent rain water from standing/flowing		T					
	(2) Accuracy requirements		T					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCT ION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.2.5.2.1.	Corrective maintenance							Title
	(1) MTTR		D					
	(2) Execution time for auto. initiated diagnostics		I					
3.2.5.2.1.1.	The process							Lead-In
	(1) Requirements		D					
3.2.5.2.2.	Bench repair		DA					
3.2.5.2.3.	Mean preventive maintenance time		DA					
3.2.6.	Environmental conditions							Title
3.2.6.1.	Natural environment							Title
3.2.6.1.1.	General							Title
	(1) Environment I					T		
	(2) Environment III					T		
	(a) Use of environmental controls					D		
3.2.6.1.2.	Antenna radomes							Title
3.2.6.1.2.1	Radome deicers							Title
	(1) Automatic operation		D					
	(2) Icing conditions		D					
	(3) Requirements of FAA-STD-022		T					
3.2.6.1.2.2.	Non-wetting surface							Title
	(1) Prevent rain water from standing/flowing		T					
	(2) Accuracy requirements		T					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.2.8. 3.2.8.1. 								

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.2.8.	(h) salt fog		T					HIL-SJD-810, Method 509.2
3.2.8.1.	(i) radome icing/deicing		T					MIL-STD-810, Method 510.2
	(j) sand & dust		T					MIL-STD-810, Method 508.3
	(k) fungus		T					MIL-STD-810, Method 514.3
	(l) vibration		T					Title
3.2.8.	Flexibility and expansion							Title
3.2.8.1.	Category III Conversion Capability							
	(1) Kit installation		D					
3.2.8.2	(2) Equipment changes		D					
	Category III System Conversion Kit							Title
	(1) Kit		I					
3.2.8.3	(2) Identical in design		I					
	Category III Equipment Configuration							Title
	(1) Category III characteristics		L					
	(a) Continuity of Service and Integrity reqs.		A					
	(b) Primary/secondary operation		D			D	D	
	(c) Manual selection of primary		T			D	D	
	(d) Automatic switchover				T			
	(e) Period of zero or erroneous guidance				T			
3.3.	DESIGN AND CONSTRUCTION							Title
3.3.1.	Materials							Title

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.3.1.4.3.	Optical Fiber		A					Title
	(1) Communications interface with optical fiber	T	A		T			
	(2) Operating wavelengths							
	(3) Single wavelength except UDM							
3.3.1.4.4.	Radio							Title
	(1) Band	T			T			
	(2) Standards		T		T			
	(3) Physical transmission media	D	I		D		D	
	(4) Single channel		D					
3.3.2.	Electromagnetic radiation		I					
3.3.2.1	Electromagnetic compatibility							Title
	(1) RF radiation sources interference		T					
	(2) Pulse interference		T					
	(3) Pulse signal tests		T					
	(4) Test conditions		T					
	(5) Type acceptance		T					
	(6) FAA-STD-022, 4.1.4 thru 4.1.4.4		T					
3.3.2.2.	Cross-talk, shielding and isolation							Title
	(1) Adequate shielding		D					
	(2) Temporary repositioning of uires or cables		D					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.3.1.4.3.	Optical Fiber (1) Communications interface with optical fiber	T	A		I	T		Title
	(2) Operating wavelengths		A					
	(3) Single wavelength except UDM							
3.3.1.4.4.	Radio (1) Band	T				T	D	Title
	(2) Standards		T	I		T		
	(3) Physical transmission media	D				D		
	(4) Single channel		D					
	(5) Electromagnetic radiation		I					
3.3.2.	Electromagnetic compatibility							Title
3.3.2.1	(1) RF radiation sources interference		T					
	(2) Pulse interference		T					
	(3) Pulse signal tests		T					
	(4) Test conditions		T					
	(5) Type acceptance		T					Title
	(6) FAA-STD-022, 4.1.4 thru 4.1.4.4		T					
3.3.2.2.	Cross-talk, shielding and isolation							
	(1) Adequate shielding		D					
	(2) Temporary repositioning of uires or cables		D					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERI FI CATI ON LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3. 3. 4. 1. 1. 1.	Printed wiring boards (1) In accordance with FAA-G-2100 (2) Plug-in type boards with suitable guides (3) Pin connection restriction (4) Multi-layer restriction (5) Memory integrated circuit sockets		I I I I I					Title
3. 3. 4. 1. 2.	LRU Level (1) Established at (2) Weight of an LRU		A A I					Title
3.3.4.1.3.	Solid state design		I					Title
3.3.4.1.4.	Site configuration (1) Split or collocated site configuration (2) Any Az interconnected with any El (3) Equipped with any MLS antenna (4) Operation in either approach direction	T A D D	A D					
3. 3. 4. 1. 5.	Accessibility		ID					
3. 3. 4. 1. 6.	Test provisions		I					Title
3.3.4.1.7.	Panel controls (1) Controls essential to proper ops or maint. (2) Locking devices (3) Operation of the lock (4) Clearly marked		I I D I					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERI FI CATI ON LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3. 3. 4. 1. 1. 1.	Printed wiring boards (1) In accordance with FAA-G-2100 (2) Plug-in type boards with suitable guides (3) Pin connection restriction (4) Multi-layer restriction (5) Memory integrated circuit sockets		I I I I I					Title
3. 3. 4. 1. 2.	LRU Level (1) Established at (2) Weight of an LRU		A A I					Title
3.3.4.1.3.	Solid state design		I					Title
3.3.4.1.4.	Site configuration (1) Split or collocated site configuration (2) Any Az interconnected with any El (3) Equipped with any MLS antenna (4) Operation in either approach direction	T A D D	A D					
3. 3. 4. 1. 5.	Accessibility		ID					Title
3. 3. 4. 1. 6.	Test provisions		I					
3.3.4.1.7.	Panel controls (1) Controls essential to proper ops or maint. (2) Locking devices (3) Operation of the lock (4) Clearly marked		I I D I					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION	SITE ACCEPT.	
		SERVICE	NORMAL	SERVICE	NORMAL			
3.3.4.3.1.	Antenna support material and design							Title
	(1) Materials and configurations		I					
	(2) Materials selected		A			I		
	(3) Lightest weight structure		A			I		
	(4) Materials for structurally loaded components		A			I		
	(5) Manufacture and workmanship		A			I		
	(6) Hot dip galvanized after fabrication		I					
	(7) Design and erection drawings		A					
	(8) Meet the frangibility requirements		A					
	(9) Work platforms over 24 in above ground		I					
	(10) OSHA safety requirements		I					
	(11) Weight limitations of MIL-STD-1472		I					
	(12) Stairs, Catwalks, and Hoisting devices		A					
	(13) Components made of aluminum alloy		L					
	(14) Components made of light gage steel		I					
	(15) Joints of structures of equipment components		I					
3.3.4.3.1.1.	Life cycle		A					Title
3.3.4.3.1.2.	Foundations and concrete structures							Title
	(1) Concrete structures/components		IA					
	(2) Concrete foundation construction						I	
	(3) Maximum slump						I	
	(4) Concrete reinforcement		I					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUCTION		SITE CCEPT.
		ERVICI	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3. 3. 4. 3. 2.	(5) Construction of all concrete work		A				I	Title
	(6) Bottom of all foundations		A				I	
	(7) Excavation deeper than the required depth						I	
	(8) Foundation designs		A				I	
	(9) Top of the foundation						I	
	(10) Top four edges of the foundation above ground						I	
	(11) Standard reinforced concrete foundation		A				I	
	(12) Piers and pedestals of an elevated structure		A				I	
	(13) Foundation design basis		A					
	(14) Foundation design considered rigid		A					
	(15) Pedestals tied together		A					
	(16) Sites located major earthquake areas		I					
	(17) Supports/foundations stability requirements		A					
	(18) Design of the spread footing foundation		A					
	(19) Base plates		A				I	
	(a) Top of the pedestal or pier						I	
	(b) Non-shrink grout						I	
	(20) Curing concrete						I	
	(21) Removal of forms and shores						I	
	Scanning Beam Antenna enclosures and mounting structures							
	(1) Design and construction		A					

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUCTION		SITE CCEPT.
		ERVICI	NORMAL	SERVICE	NORMAL			
PARAGRAPH NO.	TITLE							
3. 3. 4. 3. 2.	(5) Construction of all concrete work		A				I	Title
	(6) Bottom of all foundations		A				I	
	(7) Excavation deeper than the required depth						I	
	(8) Foundation designs		A				I	
	(9) Top of the foundation						I	
	(10) Top four edges of the foundation above ground						I	
	(11) Standard reinforced concrete foundation		A				I	
	(12) Piers and pedestals of an elevated structure		A				I	
	(13) Foundation design basis		A					
	(14) Foundation design considered rigid		A					
	(15) Pedestals tied together		A					
	(16) Sites located major earthquake areas		I					
	(17) Supports/foundations stability requirements		A					
	(18) Design of the spread footing foundation		A					
	(19) Base plates		A				I	
	(a) Top of the pedestal or pier						I	
	(b) Non-shrink grout						I	
	(20) Curing concrete						I	
	(21) Removal of forms and shores						I	
	Scanning Beam Antenna enclosures and mounting structures							
	(1) Design and construction		A					

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUCTION		SITE CCEPT.
		ERVICE	NORMAL	SERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3.3.5.2.	Software interchangeability		I					Title
3.3.6.	Safety							
3.3.6.1.	Transient protection		T					Title
3.3.6.2.	Grounding requirements							
	(1) Grounding systems		I				I	Title
	(a) Earth electrodes		I				I	
	(b) Electronic equipment frame grounding		I				I	
	(c) Signal reference		I				I	
	(d) AC power		I				I	
3.3.6.3.	Obstruction lights							Title
	(1) Dual obstruction lights		I					
	(2) Lamps in each fixture		D					
	(3) Obstruction lights installed above		I					
	(4) Field monitors		D					Title
3.3.6.4.	Low Impact Resistance Structures (LIRS)							
	(1) Station design and construction		A					
	(2) Break-away mechanisms		T					
	(3) Maximum length		I					
	(4) Maximum spacing		I					
	(5) Maximum frangibility		A					
	(6) Test methods and procedures		T					
	(7) Physical /chemical properties of material(s)	N/A						

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	SITE CCEPT.	
		ERVICE	NORMAL	SERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3.3.5.2.	Software interchangeability		I					Title
3.3.6.	Safety		T					
3.3.6.1.	Transient protection							Title
3.3.6.2.	Grounding requirements							
	(1) Grounding systems		I				I	
	(a) Earth electrodes		I				I	
	(b) Electronic equipment frame grounding		I				I	
	(c) Signal reference		I				I	
	(d) AC power		I				I	
3.3.6.3.	Obstruction lights							Title
	(1) Dual obstruction lights		I					
	(2) Lamps in each fixture		D					
	(3) Obstruction lights installed above		I					
	(4) Field monitors		D					
3.3.6.4.	Low Impact Resistance Structures (LIRS)							Title
	(1) Station design and construction		A					
	(2) Break-away mechanisms		T					
	(3) Maximum length		I					
	(4) Maximum spacing		I					
	(5) Maximum frangibility		A					
	(6) Test methods and procedures		T					
	(7) Physical /chemical properties of material (s)	N/A						

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC- TION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3. 3. 9. 2. 2.	Log-on Sequence							Title
	(1) First step		D					
	(2) RMS response		D					
	(3) Second step		D					
	(4) Verify the correctness and level of security		D					
	(5) Password characters		D					
	(6) "x" character		D					
	(7) RMS response to correct password/UID		D					
	(8) Invalid entry		D					
3.3.9.2.2.1.	Levels of Security							Title
	(1) First level password		D					
	(2) Second level password		D					
	(3) Third level password		D					
	(4) Automatic user log-off		D					
	(5) Reset automatic user log-off		D					
3. 3. 10.	Government Furnished Property Usage							Title
3.5.10.1	HPS simulator							
3. 3. 11.	Computer Resource Reserve Capacity							Title
	(a) MLS Processing Resources							Title
	(1) MLS processing resource requirements		A					
	(2) MLS system functions		A					

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE ACCEPT.	
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3. 3. 9. 2. 2.	Log-on Sequence							Title
	(1) First step		D					
	(2) RMS response		D					
	(3) Second step		D					
	(4) Verify the correctness and level of security		D					
	(5) Password characters		D					
	(6) "x" character		D					
	(7) RMS response to correct password/UID		D					
	(8) Invalid entry		D					
3.3.9.2.2.1.	Levels of Security							Title
	(1) First level password		D					
	(2) Second level password		D					
	(3) Third level password		D					
	(4) Automatic user log-off		D					
	(5) Reset automatic user log-off		D					
3. 3. 10.	Government Furnished Property Usage							Title
3.5.10.1	HPS simulator							
3. 3. 11.	Computer Resource Reserve Capacity							Title
	(a) MLS Processing Resources							Title
	(1) MLS processing resource requirements		A					
	(2) MLS system functions		A					

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		DESIGN		TYPE		PRODUC-TION	SITE CCEPT.	
		ERVICE	ORMAL	ERVICE	ORMAL			
PARAGRAPH NO.	TITLE							
3. 4.	DOCUMENTATION							Title
3. 4. 1.	Documentation to be furnished							Lead-In
	(1) Documentation related to site installations		I					Lead-In
	(2) Documentation							
	(a) Installation Drawings		I					
	(b) Design Drauings and Specifications		I					
	(c) Construction Drawings and Specs		I					
	(d) Calcul ations		I					
3. 4. 1. 1.	Configuration management		I					
	(1) Configuration management program		N/A					
	(2) Configuration management deliverables		N/A					
3. 4. 2.	Drawings							Title
3. 4. 3.	Instruction books							Title
	(1) Manuscript copies of instruction manuals/books		I					
	(2) Instruction book at the system level		I					
	(3) Individual instruction books		I					
	(4) RCSU , RSU, PMR, MLS module trouble-shooting and repair and special test equipment.		I					
	(5) MLS Module Troubleshooting & Repair manual set		I					
	(6) Section 10 of the technical instruction books		I					

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD						REMARKS
		DESIGN		TYPE		PRODUC-TION	SITE CCEPT.	
		ERV I CE	ORMAL	ERV I CE	ORMAL			
PARAGRAPH NO.	TITLE							
3. 4.	DOCUMENTATION							Title
3. 4. 1.	Documentation to be furnished							Lead- In
	(1) Documentation related to site installations		I					Lead-In
	(2) Documentation							
	(a) Installation Drawings		I					
	(b) Design Drawings and Specifications		I					
	(c) Construction Drawings and Specs		I					
	(d) Calculations		I					
3. 4. 1. 1.	Configuration management		I					
	(1) Configuration management program		N/A					
	(2) Configuration management deliverables		N/A					
3. 4. 2.	Drawings							Title
3. 4. 3.	Instruction books							Title
	(1) Manuscript copies of instruction manuals/books		I					
	(2) Instruction book at the system level		I					
	(3) Individual instruction books		I					
	(4) RCSU, RSU, PMR, MLS module trouble-shooting and repair and special test equipment.		I					
	(5) MLS Module Troubleshooting & Repair manual set		I					
	(6) Section 10 of the technical instruction books		I					

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REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION		SITE ACCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
	<p>(7) Portable MLS Receiver (PMR)</p> <p>(a) Operation any of 200 frequencies</p> <p>(b) Display</p> <p>(i) Data</p> <p>(ii) Visible</p> <p>(c) Video output jack</p> <p>(d) Data Output</p> <p>(i) Data to be output</p> <p>(ii) Interface for this output</p> <p>(e) Internal rechargeable battery</p> <p>(f) Operate on 11-16V DC</p> <p>(g) Battery Charging System</p> <p>(i) Operate while batteries being charged</p> <p>(ii) Continuous operation</p> <p>(iii). operational mode</p> <p>(h) Data output</p> <p>(i) Data to be available</p> <p>(i) Interference rejection</p> <p>(j) Evaluate field monitor inputs and OCI</p> <p>(k) Shock resistance</p> <p>(i) withstand without component failure</p> <p>(l) Weight</p>							<p>Lead-In</p> <p>Lead-in</p>
			T	T				
			D			D		
			T			T		
			D					
			D			D		
			D			D		
			T			D		
			I					
			I					
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VERIFICATION METHODS: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, C=CONTRACTOR DETERMINES METHOD OF VERIFICATION, L=REQUIREMENT SATISFIED BY LOWER LEVEL REQUIREMENT, S=REDUNDANT REQUIREMENT, N/A=NOT APPLICABLE

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
PARAGRAPH NO.	TITLE	DESIGN		TYPE		PRODUCTION		SITE ACCEPT.
		SERVICE	NORMAL	SERVICE	NORMAL			
	<p>(7) Portable MLS Receiver (PMR)</p> <p>(a) Operation any of 200 frequencies</p> <p>(b) Display</p> <p>(i) Data</p> <p>(ii) Visible</p> <p>(c) Video output jack</p> <p>(d) Data Output</p> <p>(i) Data to be output</p> <p>(ii) Interface for this output</p> <p>(e) Internal rechargeable battery</p> <p>(f) Operate on 11-16V DC</p> <p>(g) Battery Charging System</p> <p>(i) Operate while batteries being charged</p> <p>(ii) Continuous operation</p> <p>(iii). operational mode</p> <p>(h) Data output</p> <p>(i) Data to be available</p> <p>(i) Interference rejection</p> <p>(j) Evaluate field monitor inputs and OCI</p> <p>(k) Shock resistance</p> <p>(i) withstand without component failure</p> <p>(l) Weight</p>							<p>Lead-In</p> <p>Lead-in</p>
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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUC- TION		SITE ACCEPT.
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
3.5.1.3.	Support Equipment							Lead-in
3.5.1.3.1.	Special test adapters for automatic test equipment (ATE)							Title
3.5.1.3.2.	(1) Special pluggable adapters		I					
	(2) Modules to be tested		I					
	(3) The design of the adapters		I					3.2.5.2.2.
	Special test adapters for nonautomatic test equipment							Title
	(1) Special adapters required		I					3.2.5.2.2.
	(2) Modules to be tested		I					
	(3) The design of the adapters		I					
3.5.1.3.3	Special tools		I					
3.5.2.	Supply System Requirements							
3.6.	PERSONNEL AND TRAINING							Title
3.6.1.	Personnel							N/A
3.6.2.	Training		I					
3.8.	PRECEDENCE							N/A
5.1.	Preservation, packaging, packing, and marking		T					Federal Standard 101.c,

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VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQUIREMENTS PARAGRAPH REFERENCE		VERIFICATION LEVEL AND METHOD					REMARKS	
		DESIGN		TYPE		PRODUC- TION		SITE ACCEPT.
PARAGRAPH NO.	TITLE	SERVICE	NORMAL	SERVICE	NORMAL			
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3.5.1.3.2.	Special test adapters for nonautomatic test equipment							Title
	(1) Special adapters required		I					
	(2) Modules to be tested		I					3.2.5.2.2.
	(3) The design of the adapters		I					
3.5.1.3.3	Special tools		I					
3.5.2.	Supply System Requirements							
3.6.	PERSONNEL AND TRAINING							Title
3.6.1.	Personnel							N/A
3.6.2.	Training		I					
3.8.	PRECEDENCE							N/A
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